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Electrical World

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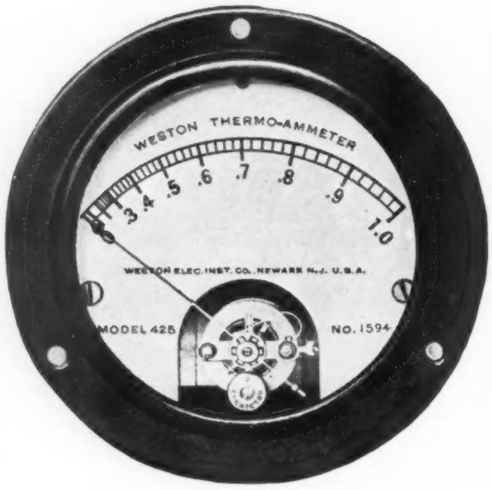

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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New York, Saturday, May 13, 1922

Volume 79 *Number* 19

Aspects of the Convention

PERHAPS no convention of the National Electric Light Association has held the significance and the opportunity which mark the gathering in Atlantic City next week. Forty-four other such meetings have passed into history, but the circumstances of this one are unique. And the men come with an unusual degree of purpose and expectation.

BEFORE this great convention will be presented for consideration this combination of conditions that affect us all:

1. The American people have lifted themselves out of the backwash of the war to the point where good times are clearly coming back again and the work of extension and expansion may be actively taken up once more.

2. The entire electrical industry, inspired by the N. E. L. A., has stepped forth in a movement to "electrify" the homes and industries of the nation, for the elimination of waste, the stimulation of economic health and the greater service of mankind, through the enjoyment of all the comforts and advantages of a broader use of electricity.

3. The great subject of superpower development and the interconnection of distributing systems is before the engineer and the executive, with new vision and new possibilities.

4. The restoration of more normal conditions in the money market has opened up a favorable source of ample funds for new financing.

5. The rapid evolution and adoption of the new idea of customer ownership of utility securities has wrought a revolution in the common conceptions both of the value of public sentiment and of the duty of the executive toward his community.

6. The coming of radio broadcasting has introduced interesting new problems for the operator and a picture of a possible opportunity for service to the public in a quite unexpected field.

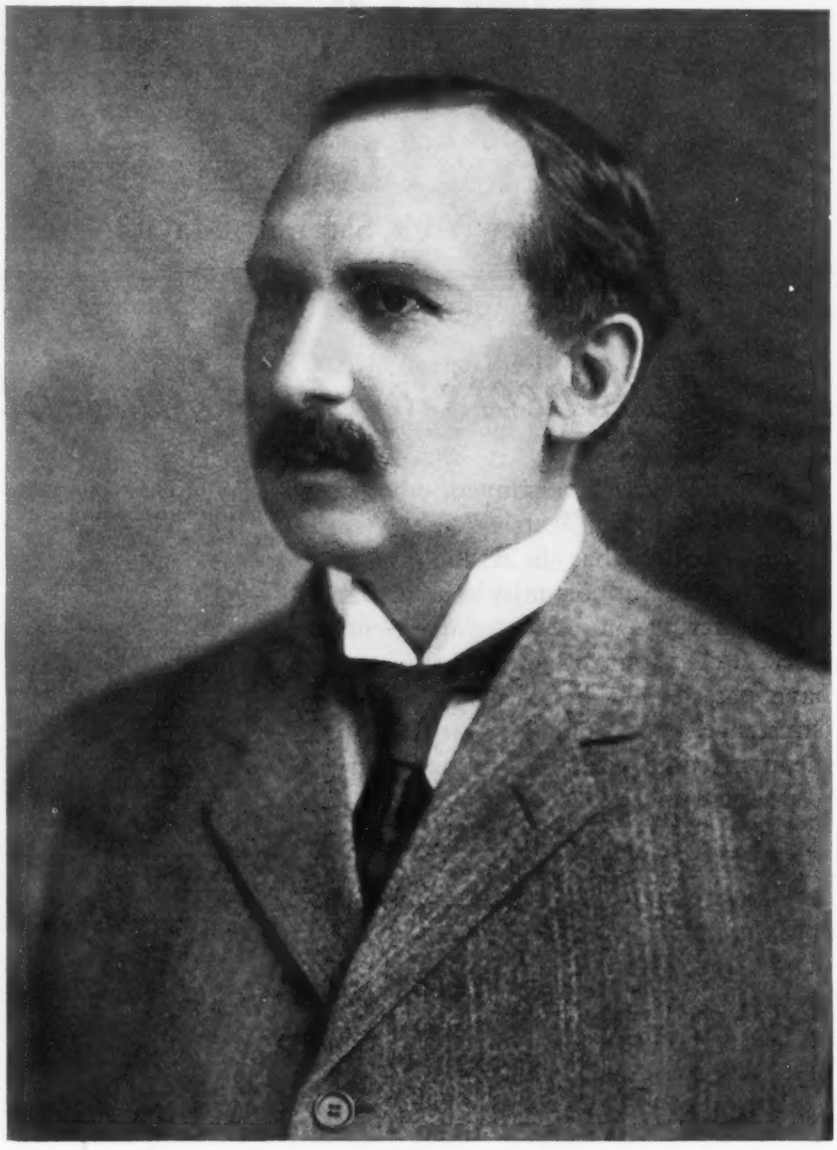
These are the interests uppermost in the minds of electrical men right now. These will be the topics talked about in the meetings and among the groups who gather to exchange the personal experiences that give so great a value to these great national meetings of central-station personnel. And it is an inspiring thought that back from Atlantic City to all the communities across the land these men will carry the potential progress of the coming year in terms of electricity.

THE cost of such a convention in time and money is as nothing compared with the profits that can be taken from it both for the central-station industry and for the people whom it serves. For there is no source of education like contact with other minds all eager in the common problems. And in this business both knowledge and imagination must be sought abroad.

To President Bump and the members of the National Electric Light Association at Atlantic City the ELECTRICAL WORLD extends its greetings and its heartiest congratulations. This year and this convention will be rated high in the annals of the industry. The year to come promises great things.

Sidney Z. Mitchell

A pioneer in public utility work and one of the foremost financiers in the industry.



FEW men in the public utility business possess such an intimate grasp of all its phases as Sidney Z. Mitchell. Whether as pioneer, operator or financier, Mr. Mitchell's ability is everywhere acknowledged. One has but to consider the magnitude of the undertakings that come under his supervision and the initiative skill and vigor displayed in their management to comprehend the man in part.

Mr. Mitchell's connection with the electrical industry started soon after his graduation from the United States Naval Academy in 1883. The fall of 1885 found him pioneering in the Northwest as agent for the Edison incandescent lighting system. In order, however, that no detail of the Edison system should escape him, Mr. Mitchell first served a sort of apprenticeship in the company's Goerck Street shops in New York. On reaching Seattle, Mr. Mitchell organized and financed the firm of Mitchell, Sparling & Company, which held the exclusive right of erecting Edison plants in Alaska, British Columbia, Washington, Idaho and Oregon.

Just as the year 1885 was about to pass into history Mr. Mitchell contributed to its annals by starting on Dec. 30 in Seattle the first incandescent-lighting central-station plant west of the Rocky Mountains. The city had then a population of about four thousand, and the incandescent lighting-load was fed from a No. 10 25-kw. Edison machine. Service was at the rate of $3 per lamp per month. From that time Edison stations were installed in rapid succession, and such was Mr. Mitchell's success that the General Electric Company brought him to New York in 1905 to organize the Electric Bond & Share Company. As head of that company Mr. Mitchell's genius for organization had greater scope, and as a result he directs to-day the activities of the largest aggregation of central-station organizations in the world, embracing such systems as the American Gas & Electric Company, the American Power & Light Company, the Utah Power & Light Company and a number of others. Of late years Mr. Mitchell has concentrated his attention principally on problems of finance, and his knowledge of this, coupled with his schooling and experience in the public utility business, has made his counsel and advice especially valuable to the National Electric Light Association, of whose public policy committee he has been chairman for the past two years.

Editorial Comment

Electrical World, May 13, 1922

Volume 79 Number 19

Respite for the Industry Is Over

WHEN the industrial depression settled down over the country last year it was felt that the central generating and distributing companies would have a brief respite from the constantly accelerating growth which has characterized the industry during the past decade. The data which have been published during the past six months indicate that this respite has indeed been brief. In fact, thirty-three of the seventy-six companies having an output during 1921 of more than a hundred million kilowatt-hours reported an output in excess of that reported for 1920, and in February of this year the average daily output exceeded that of any previous month in the history of the industry. The industry must now hasten its building program if it is to be fully prepared, for with the return of industrial activity to normal and the addition of about twelve hundred thousand new domestic lighting customers energy requirements next winter will tax its generating capacity to the utmost.

As indicated in this issue, it is estimated that the industry will spend $325,000,000 for additions and extensions to existing systems during 1922 and will add 1,772,000 kw.-hr. to the generating units of the country. This is the largest amount ever spent by the industry for extensions in any one year, and the added generator rating is also far in excess of any previous yearly addition. How far this new equipment will exceed or go toward fulfilling the added needs of the country for energy is, of course, entirely dependent upon the degree to which industry in general will return to normal productivity next fall. The industry, however, is evidently on its toes and arming itself in no small way for the materially increased call for energy which is certain to come.

Service to Farming Communities

ALTHOUGH the rapid spread of interconnected high-tension networks necessarily brings the farmer and rural communities nearer to electric power circuits and dependable twenty-four-hour service, it is nevertheless expedient for the industry to reach out in other ways after the farmer wherever it is economically possible to do so. The farmer, of course, can do much on his own behalf, but he can hardly appreciate a thing he has never experienced or miss a thing he never possessed. Only those farmers who have installed farm-lighting outfits have any comprehension of the conveniences of electricity or any adequate idea of the value of central-station service. It is possible for a number of farmers to combine and erect at their own expense standard circuits for electric service if they are provided with the specifications. Experience has shown that farmers in a great many cases put up better pole lines in quicker time than erecting crews of electric light and power companies. This is one way of encouraging the farmer and of keeping down the cost of extensions to a minimum. It does not solve the problem entirely, however. The house and barns must also be equipped. Inasmuch as all cities, not industrial, are dependent on the farming communities which surround them, anything which helps the farmer to become more productive necessarily means that much added prosperity to the city. One who cannot discern this relationship must be lacking in intuition. Hence the advantage of electricity on farms and the wisdom shown by the National Electric Light Association in devoting so much attention to rural-line extensions.

Selective Selling and Salesmen's Compensation

ONE of the inevitable issues that will develop with the quickening of business activity and selling effort among the utilities will be the old, old question of how to pay the salesmen. Shall it be a straight salary, a combination of salary and a bonus, or a commission with a nominal salary base? Shall the salesman be left to sell the thing that is easiest, or to specialize on his particular hobby—as, being human, he will do—or shall it be made automatically interesting and profitable to him to direct his energies to the creation and development of the kinds of load that are the most valuable and satisfactory to the company?

The old ways of the old days, when the thought uppermost in the salesman's mind was to find somebody to whom something could be sold, have to be laid aside. It is not just a question of disposing of the capacity or of getting the greatest number of contracts signed. After all, the purpose is to sell the output of the stations for the most profitable return by selecting the classes of business that will combine efficiently to provide a creditable load curve. It is the purpose also to obtain this business in locations where the expense and investment entailed in connecting and serving it are as small as possible, and to do this it is necessary to exercise both discretion and intelligence in the selective development of new business, that out of it may come the maximum service to the community and generous profits to the stockholders.

To bring all this about there must be more than conversation, more than the analysis of the local market. There must be some practical provision that will stimulate the salesman to work for the best class of business by rewarding him according to his achievement. Commissions paid on appliance sales only have not been found to be the influence that is needed. Should it be a combination based on both sale profit and energy consumption? The whole matter is one of no small importance.

Savings Bank Investments in Utilities

THE constitutions of some states permit saving banks to invest in high-grade public utility securities, but in the great majority of the states such permission is withheld. Obviously it is necessary to safeguard the savings of people who by thrift and hard work have managed to accumulate a small amount of money for a rainy day. The history and constancy of earning power of some utilities, especially electric light and power companies, have been such, however, that many persons of means seeking sound investments have looked rather favorably on them. It was felt that if the securities of well operated and managed public utilities were considered sound enough for conservative investors, there was no reason why savings banks should not also be permitted to put some of their accumulated funds in such bonds. Certainly, if there was any doubt about the soundness and stability of the investments, reputable utility men would not suggest them to savings-bank officials and the latter would be the last to wish to jeopardize the funds intrusted to their care. It is significant, therefore, that both the Association of Mutual Savings Banks and the National Electric Light Association should seek to remove the constitutional inhibitions against investments by savings banks in public utility securities. Thus far considerable progress has been made, and there is every reason to believe that within the next few years the securities of public utilities properly safeguarded may become legal investments for mutual savings banks. Incidentally, this work shows the advantages of co-operation through national associations, whereby hundreds of millions of dollars may be made available for public service, with mutual benefit to the borrower and the lender.

Scheduled Inspection Will Forestall Service Interruptions

EVERY progressive electric service company and industrial plant insists on regular inspection and maintenance of its equipment, and some companies put their schedules on paper. Relatively few, however, go into the details of outlining exactly what conditions shall be particularly observed and what degree of abnormality will be tolerated, the judgment of the inspector being relied upon instead. If he has had long experience, this practice may be right, but every company must shape its plans to include the cadet or newcomer as well. Furthermore, the responsibility for inspection should be definitely fixed, and the records should show the condition of all equipment at any time.

A system which meets all of these requirements is discussed in this issue by Alex. Bauhan of the Pennsylvania Water & Power Company. He describes means of obtaining better maintenance which can be applied to any kind of industrial undertaking. The scheme is to keep the men responsible for upkeep interested in their work by providing for them a method of continuously watching its progess. At any time by simply looking at a chart on the wall the status of each man's work and of the detailed inspection can be checked up to date.

This system is based on a comprehensive outline which is widely distributed among the men. This outline is complete in all details, telling exactly what must be looked for and what kind of report is wanted on each class of equipment. The responsibility is divided among all, and interest is aroused by the fact that the work is constantly verified and under criticism by means of visible charts. A systematic "follow-up" of repairs, using similar charts, is also provided for. A study of the various charts will at any time indicate what maintenance work must be done in the future, show when this work is done and provide means of bringing about improvements based on absolute records of performance. An inspection system to insure upkeep built upon more correct fundamentals is difficult to conceive.

Some of the Higher Strategy of Engineering

SOME scoffer once defined an engineer as a man who could do for fifty cents what any fool could do for a dollar. This is overstressing the economic side of engineering, because sometimes it is necessary for the engineer to spend several dollars to accomplish what any fool thinks he could do for fifty cents. However, the economic problem is one which constantly confronts the profession. A paper by L. R. Lee in the current issue brings up in a very suggestive way the sort of thing with which the engineer has to struggle—with more or less success according to his skill and to his economic environment. The latter is no small item, not in what constitutes good engineering, but in imposing limits of one sort or another upon those things which the engineer is at liberty to do and in which he must, within those limitations, reach the best possible results.

Looking at the matter broadly, there are two radically opposite economic situations which the engineer has sometimes to meet. First, he may find himself confronted by the fact that his clients are engaged in a desperate financial struggle even to keep their noses above water, let alone to swim high and comfortably. He finds the line of operations which is clearly indicated by the necessities of the case entirely blocked. He would like to build a station giving the necessary output at the best possible figure, but discovers that there is no money in sight which can possibly carry out his plans on an adequate scale. Whether he likes it or not, he must economize, giving his clients not the kind of station which ought to be built but the best expedient for which they can by the utmost effort raise money to pay. The problem may take various forms. It may be necessary to cramp the capacity in a station, to sacrifice something of efficiency, to give up the hope of homogeneous equipment, even to forego the installation of copper that is really needed; but if the engineer knows his business, he can balance one factor against another, always with an eye to the possibility of future financing, and achieve a plant that will at least give reliable service and permit of later improvement.

A directly opposite situation, although not quite so common, falls within the experience of almost every engineer sooner or later in his practice. The financial backers, when the engineer comes to analyze their real demands, wish to obtain as imposing and showy a plant as possible to serve as the basis for a bond issue considerably bigger than is necessary to carry out the dictates of sound installation practice and to put the plant in first-class earning condition. In the one case the necessary thing is to keep down expense, in the other to keep expense up to the limit that the bond market will stand for. The condition of an engineer thus transferred from poverty to riches is a very curious one. His plant must be above all things con-

servative, following only lines which other plants carrying huge bond issues have followed, and no expense must be spared for which any ostensible reason can be drummed up. Far-sighted economic practice must take a back seat. It is not "standard." This may sound like a fancy picture of a constructor's elysium, but it is not.

Providentially, neither extreme is now so common as the middle ground of trying with somewhat limited means to do the very best possible for the system, and this more than anything else involves a really prophetic spirit as well as limitless finesse in equipment. For instance, a combined steam and water station is under way. Will the market outrun the conservative minimum capacity of the hydraulic privilege in one year or in twenty? Will the load ten years from now stand any chance of justifying the immediate development of the privilege to a fair maximum value, backed by a steam station? If so, where shall the station be situated with reference to the coal prices in 1932, and will it pay to go in at once for a high-efficiency steam plant on the theory that it will be pretty steadily required at the later date? May it not be wiser to look forward to linkage with a somewhat distant hydraulic plant of large capacity from which power can be bought at a price comparable with the then probable price of steam power?

If a transmission line has to be built, is it better to have one steel-tower line running direct or, at the same expense, a ring circuit of cheaper construction with wooden poles, and in either case what will prove to be the most desirable voltage in view of possible interconnection later? Shall we play the limit now or take the conservative view and probably have to reinsulate later? These are the sort of questions for which every engineer has sooner or later to seek answers, and they are the kind of thing for which no formal training will ever qualify one. The power to analyze these complicated situations and pick out the wise line to follow in dealing with them are the things which separate the skillful engineer from the duffer. Mr. Lee has done the profession a good service in marshaling some of the things which engineers have to face in an array which, if not always encouraging, is indubitably instructive.

Change to the Three-Phase, Four-Wire System Not So Difficult

THE ELECTRICAL WORLD has advocated repeatedly the more common use of the three-phase, four-wire system of distribution. The fundamental advantages of this system have been pointed out from both the operating and the economical standpoint. This system is in both respects the most advantageous possible for any given voltage. It has often been asked in these columns why so much hesitancy has been shown in adopting it. The answer seems to be that opposition to the change is due in great part to the seemingly difficult and expensive work of cutting over from one system to the other. This obstacle is not so serious as many think, and it can almost always be overcome.

It is gratifying in this connection to call attention to the article in this issue showing how the West Penn Power Company made a successful change in Connellsville from the two-phase system to a three-phase, four-wire system under conditions that were apparently of more than usual difficulty. We hope a study of this successful change will encourage others who are facing the necessity of improving their distribution conditions and are afraid of departing from present practice.

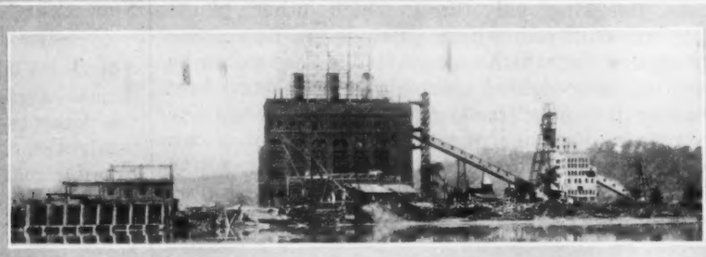
Something New in Service —the Load-Curve Barometer

IN CLEVELAND and in Utica the bankers and business men are habitually studying the load curve of the local central station as a practical barometer of local business. Could there possibly be any more impressive manifestation of the vital nature of the service which this utility renders to the community? The fact that the power used is in direct proportion to the number of operatives and machines at work and therefore to the output makes this index a closer tally on actual business than either bank clearings or sales, and the power load provides a diversity of contacts that makes the record most dependable. The details of the experience in these two cities are given in this issue.

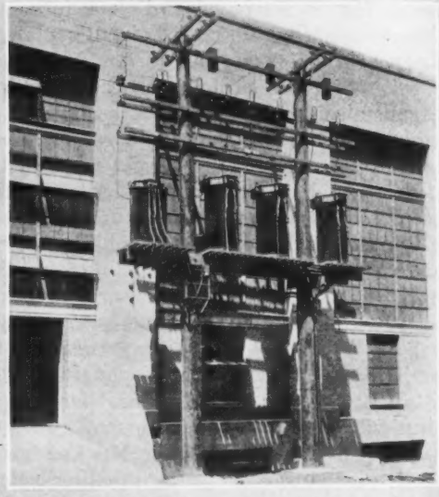
There is something more in this, however, than a gratuitous service to business men. Above all, it is a demonstration of the adaptability of electric service to the needs of industry and the well-nigh universal dependence upon the central station for that most fundamental resource of all lines of business—power. To impress this thought upon the public and establish a more observant and interested recognition of this economic element which every light and power company contributes to local industry is worth any amount of effort on the part of the management. But it is a matter of no difficulty whatever to prepare a load-curve chart and an interpretation for the business man, and to maintain it and distribute it each month to all who will be interested. It will not only tell the story, but will serve to recall continually to the mind of the business man just what the power company means to him.

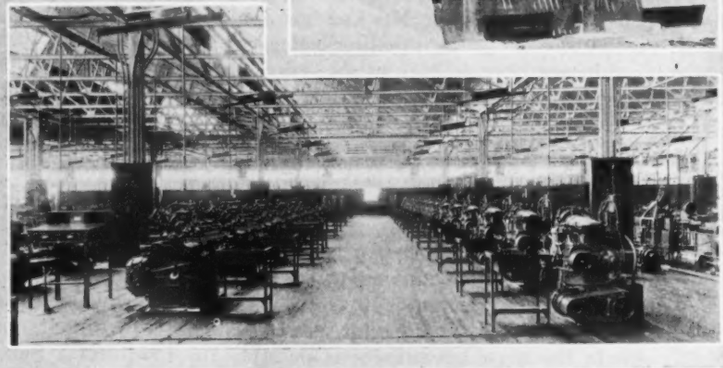
Interconnection of Small Systems

ONE excellent result of the discussion which has centered around interconnection is that it has served to clarify the situation. There is no question of the economy of interconnection and of the enormous other benefits accruing to users and utilities alike where large systems are involved, and hence the initiative for most interconnections has come from the operators of large systems. It is only because the economic and operating conditions inherent in such a scheme are not so instantly apparent to the operators of small systems unless it involves supply from a superpower station that among them the practice has been permitted to lag. However, operators of small stations will find it not only convenient but profitable to interconnect. Service is thereby improved in quality and decreased or stabilized in cost, and not infrequently, owing to the diversity of the interconnected system, added loads can be taken on without increasing the equipment. In all cases of interconnection the amount of reserve necessary to guarantee service is reduced. There seems to be an erroneous idea to the effect that interconnection involves heavy expenditures if the economic benefits latent in particular situations are to be realized, but it is surprising to note the improvements that may be had by the outlay of only trifling sums and the operating advantages which accrue from unified operation and control. In fact, interconnection shows up to advantage on smaller systems, and there is no reason why it should not be followed as a reasonable policy when justified on engineering and economic grounds.



OPPORTUNITIES





WITH water powers undeveloped and superpower stations at coal mines still to be built; with power houses and systems to be interconnected and industries, farms and homes waiting to be equipped; with commercial departments more or less dormant and new applications being found daily, the opportunities of industry are immense.

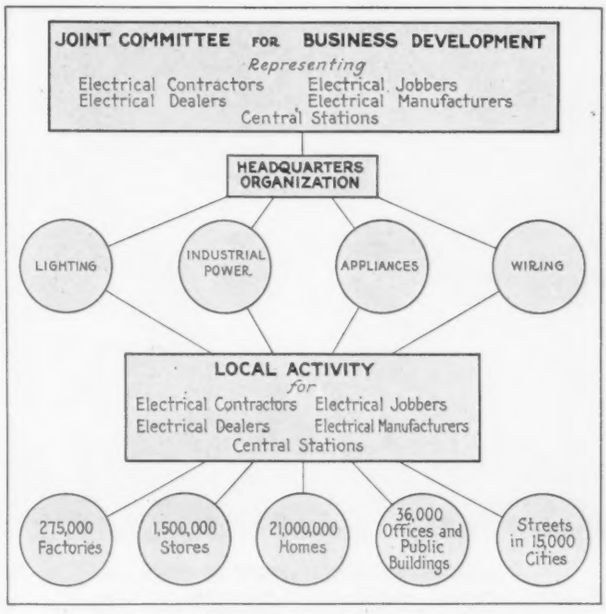
Business Development—What It Means to the Central Station

By EARL E. WHITEHORNE
Commercial Editor Electrical World

The New Conditions and Their Import—The Electrical Industry Not Ready—How the Central-Station Company Must Build Up Its Selling Staff and Help to Organize the Local Electrical Trade

THE electrical industry has embarked on a great movement for business development. Business development is to be the keynote of the convention of the National Electric Light Association in Atlantic City. It has been the outstanding feature of the administration of President Bump. It is to be the chief objective of the incoming administration of President Smith, and this monster meeting at Atlantic City will launch the program that is intended to result in a continued effort to be maintained through five or ten years and to set up a permanent progressive policy of creative business development activity that will embrace the entire industry in all its branches.

Such is the purpose. It was proposed by President Bump in January to a gathering of men representative of central-station companies, manufacturers, jobbers, contractors and dealers who had been called together to discuss the opportunity. It has been indorsed by the organized associations of all interests. The principle has been unanimously accepted, and a joint committee for business development has been established to develop the plan and carry it forward. This committee has formed sub-committees, and these subcommittees have produced and published five guide books, one on organization and one each on lighting, appliances, wiring and industrial power. The inevitable period of preliminary general conversation has passed and the time for action has come.



BUSINESS DEVELOPMENT IN THE ELECTRICAL INDUSTRY

This chart pictures the purpose of the big movement for business development following from the joint committee through the subcommittees on the four major subjects, through the local electrical men to the consumer.

The question is: What shall be done first? And the answer is a double one. First of all, we must concentrate on tuning up the industry to fit the conditions in the country, and, second, we must tune up the habits and the functioning of the different branches of the electrical industry so that they will harmoniously coordinate in this great common purpose. "Billy" Sunday, when he used to pitch his "gospel tent" and start a new series of revival meetings in another town, would stretch a banner behind the pulpit platform and on the banner were the words "Get right with God!" The meaning was clear, and there could be no argument about it. The electrical industry needs a banner in its own campaign tent right now. It would be well if it could be displayed before every meeting of electrical men of every class that will be held this summer. The banner should read "Get right with the times!"

For conditions have been changing very rapidly. Out of the world war we came into first a boom and then a valley of depression. After excited years in which the art of selling demoralized into habitual order taking we have swung back into a natural market where goods must be sold by intelligent creative work. After an abnormal period in which manufacturers and jobbers were continually oversold and exercised their ingenuity not in the development of business but in the avoidance and selection of it we have restored competitive conditions. During the war the demand for central-station service, for electric power and heat and light and appliances was overwhelming. Capacity was sold and oversold, and it became a problem of prevention and conservation, not expansion. So central-stations reduced their selling staffs and finally in very many cases eliminated the salesman entirely. Today, with the war load gone and with costs reduced so that more business becomes both desirable and profitable, the central stations of the country, with certain notable exceptions, are either undermanned and underorganized or altogether lacking in readiness to play their vital part in the great movement for business development which the conditions in the country now justify and both the service of the public and the prosperity of the industry demand.

For good times have returned to America, and we—the people—are slowly beginning to realize it as we

watch the continuous encouraging procession of the symptoms of better economic health that are now approaching on the horizon. Every newspaper we read tells more about it—larger industrial production, increased employment, cheaper money, bigger sales totals, lower cost of living, more car loadings, railroads placing orders, farmers getting back upon their feet, building construction steadily accelerating, record business on the stock exchanges, expressions of confidence and satisfaction from the big men of every trade and class, plus a continual contact with personal acquaintances and friends who cheerfully testify that "business is picking up." Clearly the public is taking heart, and we but wait the full, gradual realization of all these things by every man and woman before building and buying will be restored to free activity and the people of America will proceed to repair and replenish and restore all those things for which they have been prudently waiting so long.

The reaction upon the electrical industry of this expanded demand through all the channels of business will be tremendous. There are 5,350,000 homes still unwired along existing central-station lines. How many of the householders in these homes have decided that when times are better they will have electric light at last? Nobody knows, but it requires little imagination to realize that there is an infinite number. In the background beyond the lines and in the country there are 8,000,000 other homes. How many will desire to buy farm-lighting plants? How many will be clamoring to be connected from the nearby power lines? Over 1,100,000 lighting customers were added to the central-station load in 1921. It is estimated that 1,231,000 will be connected this year, and 1,179,000 next year, and 1,179,000 in 1924. The bulk of the new business, it is safe to say, will be in homes.

It is known that during the war, when domestic servants were so hard to get, a great impulse was given to the popularity of electric household appliances. All these newly wired homes will need and want and can be made to buy appliances, and practically all the other millions of already connected houses are underequipped and offer to the industry a market past all calculation. And what of the proportionate volume of commercial lighting business, of street lighting that has waited for good times, of industrial power, of industrial heating, of electric vehicle load?

In every field the normal development has been retarded in the last few years. It lies before the salesman now. Truly as an opportunity it makes a picture that the mind's eye cannot span.

THE INDUSTRY NOT READY

The market is ready. But the industry is not ready, and so this movement of business development has been initiated. The joint committee has been set up to tie all classes of electrical men into the work, and the National Electric Light Association has led in the movement as an example to every individual central-station company. For the accomplishment of this development must be achieved locally—in the educational activities, the publicity and selling of individual electrical utilities, manufacturers, jobbers, contractors and dealers to the people of their own communities. And in each town the central-station executive, the central-station commercial staff and the central-station policy will form the keystone of the arch on which the local movement will either stand or fall.

PROMINENT DISPLAY SPACE IS VITAL

The successful central station salesroom must be not only a display room but a practical store that makes it easy and comfortable for people to get acquainted with all the old and new ways of "doing it electrically" and to buy what they want. This is the model "floor" of the Nebraska Power Company in Omaha.

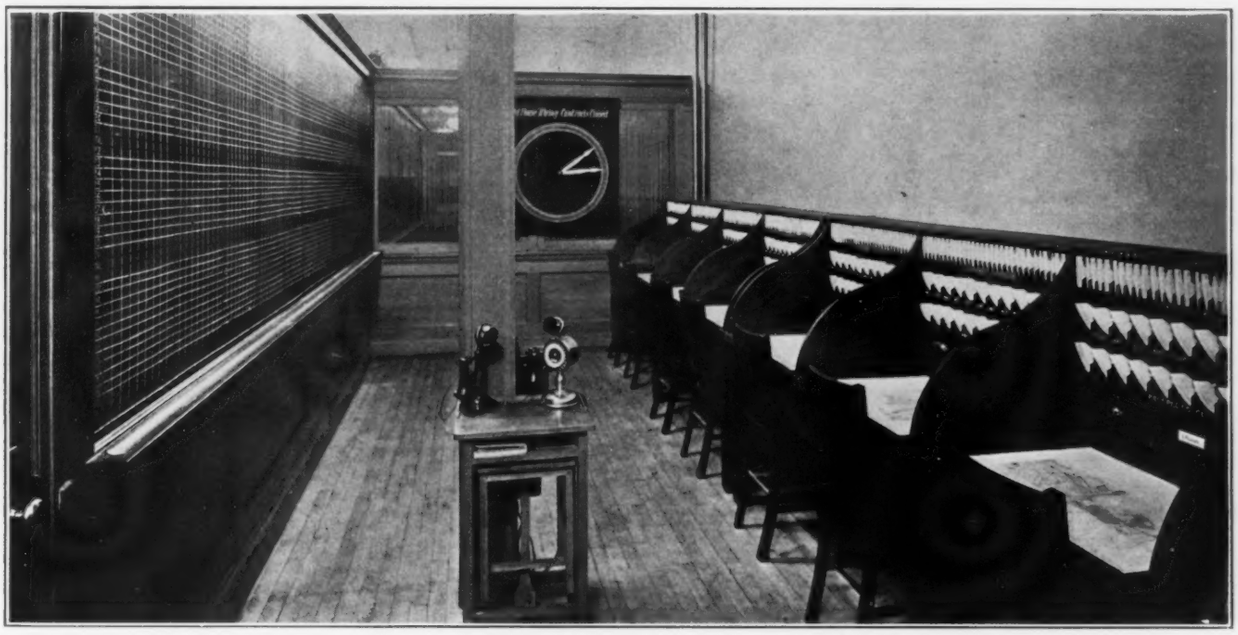
What should the central stations do in this great industry movement—each in its own town? There is nothing difficult about the answer, because the records of the most successful of our central stations point the way. The point is that these things cannot be merely talked about; they must be done by systematically proceeding to set up a properly functioning sales department by a series of progressive steps.

WHAT THE COMMERCIAL MANAGER MUST BE

First, the central station must secure a commercial manager, and this is perhaps the hardest step, for there are unfortunately fewer trained and able commercial

managers in the industry than there were ten years ago. During the war and after it many were cast out and scattered. Many went into other departments and other businesses. New material will have to be attracted to the work. Electrical men of marked merchandising instinct and ability must be put into these positions and trained for the leadership which they must exercise in their communities. Or other men with merchandising instinct and sales experience in other lines must be schooled for the work.

For the opportunity is greater than the scope of our existing organization. New commercial managers must be recruited. Let them come from the ranks if there are proper men at hand, but the first consideration is to get the job done soon and well, and if the right man is not available within the organization, he must be secured from some other source. First of all, he must be an executive, a salesman and a friend maker. This instinct and this power must be in him, and it is better to take him from outside and school him with electrical knowledge than to pick an electrical man just because he is such, if he lacks these qualities that are essential to success. Then this commercial manager must have men—



EVERY SALES STAFF NEEDS GOOD QUARTERS

The successful central station commercial department must be equipped with every facility for good work. This is the headquarters of the selling staff of the Pennsylvania Power & Light Company, in Allentown, a model office, complete in all details, with salesmen's desks, district maps, prospect card racks, blackboard and quota dial.

A lighting salesman who will go to factories and stores and offices and homes and sell a better standard of illumination and build up more and better lighting business.

A power salesman who will go to factories and shops and stores and all the local industries and introduce electric power and industrial heat for every possible application and build up more and better power business.

An appliance salesman who will go to the homes and to the offices and to the stores and sell the idea of "doing it electrically"—to outfit every customer with electric labor-saving and comfort-buying appliances and build up more and better appliance business.

An advertising-lighting salesman who will go to every merchant and business man in town as a specialist on advertising by illumination, to sell them the profitable uses of window lighting, signs, outlining, ornamental street lighting, illuminated bill boards and floodlighted buildings and build up more and better advertising-lighting business.

A wiring salesman who will co-operate with the local contractors and actively sell wiring to both old and new homes and additional lighting and convenience outlets to every domestic and commercial customer and build up more and better load and a more complete electric service for all connected customers.

An electric vehicle salesman, in all large cities, who will educate the merchants and the manufacturers to the advantages of electric road trucks and industrial trucks and tractors, co-operating with the vehicle manufacturers to build up more and better storage-battery business.

EQUIPPING THE COMMERCIAL STAFF

The commercial staff must then have things to work with—quarters for the salesmen, with desks, charts, a quota dial, a blackboard and card files, an appliance store and the right policies. A power survey must be made, and an appliance survey, so that the selling may be done in known quantities and not by guess. For the commercial department that is to be right with these times must be made up of "net salesmen" and not "gross salesmen." The old idea that any kind of business is good that will absorb capacity has got to go. For it is not enough to contract for a thousand kilowatts to one big industry and have it safely sold at the minimum rate, while there is small-power business, store-lighting and sign business and residence appliance business waiting and ready to be more profitably developed.

By all means, open the doors to business of all kinds, but build up the load balanced for net returns and not for gross output. It does not pay to carry goods to the new far-distant customer, when, more profitably and easily, you can develop other equally good business that you are now passing as you go down each street.

The commercial department which will function properly in these new times must be an organization that

is in business to make money as any other business does. And the profits of the sales at proper prices of appliances and equipment can be made to carry the expenses of the department, rent, salaries, overhead and other costs. It has been done. It is being done. It can be done in other cities. It must be done if the central-station sales department is to measure to its opportunity and function as it should in the local trade.

ORGANIZING LOCALLY

For in this great nation-wide movement for business development initiated by the electrical industry everything depends on the local organization. But the central-station company is the keystone of the arch—not the whole arch. Even as the N. E. L. A. has led out for the industry, so must the individual central station lead out for the local family of electrical men in each community. No electric light and power man or men can do the job alone. And in the five guide books which have been prepared by the joint committee are suggested the steps by which the work of organizing an electrical league in each city should be carried out—first a meeting of a small group of the recognized leaders of the local group, next a general meeting to appoint committees to set up ways and means to start the work, with practical provision for administration, financing and a permanent program.

In this local plan not only electrical men must be engaged, but in so far as possible the local chamber of commerce, the press, the pulpit, all other public utilities and the other trades which will naturally be interested in helping in any movement that in the end will tend to bring about more building and buying. Architects, builders, carpenters, plumbers, painters, decorators and lumber and hardware people all can assist, and all will if they are shown the bigness of the plan.

The purpose of this movement is obviously greater and broader than any mere drive for orders. The clear-cut objective of the initial phase of the development must not be to carry the slogan "more business, better business," as was first suggested, for the electrical industry is not going to the people of America with an appeal that says just "buy my goods!" The real need is to carry to the public a confident belief in the fact that good times are indeed here and a willingness to lay aside fear and go ahead. Therefore, as a permanent slogan and a word of inspiration both to electrical men and to the country, there has been set up for universal use in the movement the call, *"Electrify!"* The industry will set to work with cheerful assurance, careful preparation and thorough work to electrify the factories, stores, offices, streets, farms and households of America. It will quicken the pulse of local business, restore and expand the prosperity of the electrical industry and render a service to the nation and to mankind of a value beyond conception. It will be not a campaign but a continued development that will hold through the years, reacting to the continued change and evolution of this fast-unfolding electrical era.

THE HEADQUARTERS FUNCTION

From the headquarters of the joint committee will come the national guidance and co-ordination of the work. Coming into contact officially with the associations that represent the different classes of electrical men, and directly with the many local workers who may not be affiliated with these organizations, this committee, which is composed of the elements of all four branches of the industry, must continue to function as the executive director of the work. H. O. Lane, who is officially the director of the movement, is most fortunately experienced for the office.

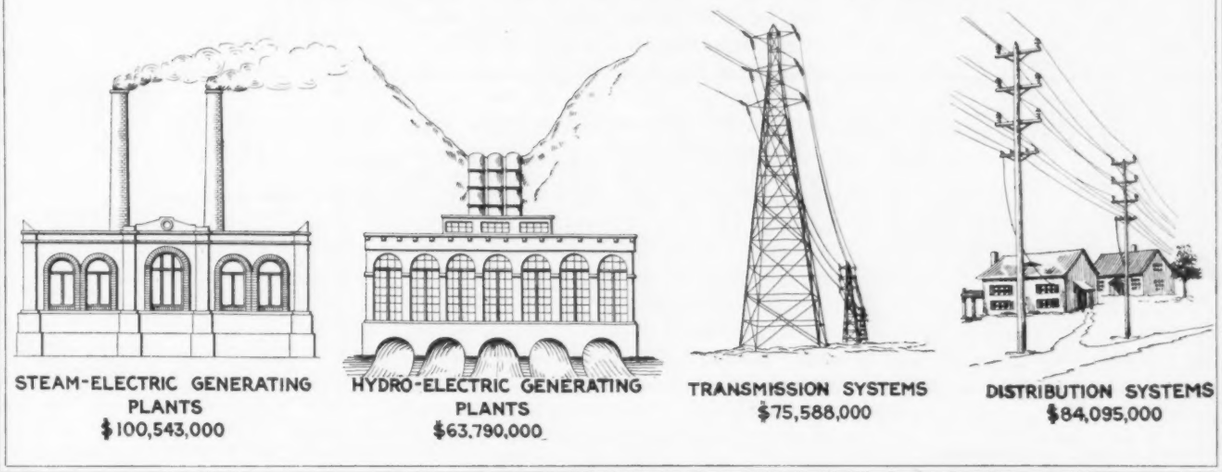
The tender of the services of the entire staff of the Society for Electrical Development provides a force of trained publicity and promotion men and women that should serve as the workshop of the industry to produce the data, the literature, the motion-picture films, the public speakers and the infinite variety of other material aids that will be needed. It is this kind of work for which the society was orginally conceived and established—a work that can best be conducted by a neutral agency serving and supported by all classes of electrical men, without bias or favor.

Such is the vision of this opportunity. And the time is now come to take up the work in each community.

The Joint Committee for Business Development

Chairman: R. H. TILLMAN, Consolidated Gas, Electric Light & Power Company, Baltimore.
R. H. BALLARD, Southern California Edison Company, Los Angeles.
A. K. BAYLOR, General Electric Company, New York City.
A. A. BROWN, Westinghouse Electric Company, New York City.
MILAN R. BUMP, President N. E. L. A., Henry L. Doherty & Company, New York City.
E. L. CALLAHAN, Westinghouse Lamp Company, New York City.
LE ROY CLARK, Safety Insulated Wire & Cable Company, New York City.
REX COLE, Duplexalite Works, New York City.
C. L. COLLENS, 2d, Reliance Electric & Engineering Company, Cleveland.
S. E. DOANE, National Lamp Works, Cleveland,
F. R. FARMER, Beardsley Chandelier & Manufacturing Company, Chicago.
R. E. FISHER, Pacific Gas & Electric Company, San Francisco.
M. T. GLEASON, Gleason-Tiebout Glass Company, Brooklyn, N. Y.
C. E. GREENWOOD, Edison Electric Illuminating Company of Boston.
C. E. HILLIS, Electrical Appliance Company, San Francisco.
A. J. HIXON, National Association of Electrical Contractors and Dealers, Boston.
F. A. KETCHAM, Western Electric Company, New York City.
E. W. LLOYD, Commonwealth Edison Company, Chicago.
C. K. NICHOLS, New York Edison Company, New York City.
GEORGE OSBORN, Edison Lamp Works, New York City.
W. R. PUTNAM, Idaho Power Company, Boise, Idaho.
W. E. ROBERTSON, Electrical Supply Jobbers' Association, Robertson-Cataract Electric Company, Buffalo.
FRANK W. SMITH, vice-president N. E. L. A., United Electric Light & Power Company, New York City.
L. R. WALLIS, Edison Electric Illuminating Company of Boston.
P. B. ZIMMERMAN, National Lamp Works, Cleveland.

Additions to Systems During 1922 Will Total $324,016,000



"Electrical World" Survey Indicates that $100,543,000 Will Be Spent for Extensions to Steam Generating Plants—North Central States Lead in the Amount to Be Expended

IN ORDER that the increasing demand for electrical energy may be met, the electric light and power industry of the United States will spend more than $324,000,000 during the year 1922 for extensions to generating and distributing systems. This record figure for extensions, which is in excess of the total income of the industry for 1913, is over 51 per cent greater than that spent for similar purposes in 1921.

These figures are based on a survey of the new construction plans of the country just completed by the ELECTRICAL WORLD, the details of which will be found in the accompanying tables. Returns were received from 237 companies distributed throughout the country. The best returns were those from the Pacific Coast, from which section reports come from companies representing 86 per cent of the installed generator rating.

The total value of the new additions to the central generating, transmission and distributing systems during the present year is estimated at $324,016,000. The estimated new generating installation totals 1,772,000 kw., of which about 58 per cent is for steam plants and 42 per cent is for hydro-electric plants. How far this new equipment will go toward filling the needs of the country for energy is questionable, depending largely upon the extent to which the industrial and lighting requirements increase during the year. Reports received for February of this year indicate a record energy output by the central stations of the country, and the industrial load at the present time is undoubtedly on the increase. It is estimated that 1,231,000 new residential lighting customers will be added to the central-station lines during 1922. These two ascending loads point to a material increase in energy requirements during the last quarter of this year. The total amount to be spent during 1922 for extensions to the transmission and distribution systems is estimated at $159,683,000, or 49.2 per cent of the total value of all estimated additions this year. In 1921 it was estimated that $119,144,000 was spent for extensions to the transmission and distribution systems, or 55.4 per cent of the total value of all additions made that year.

The greatest expansion during 1922 will take place in the North Central States and will reach a total of $96,700,000, of which about 54 per cent will be spent for new transmission and distributing systems and for extensions to those now existing. The Middle Atlantic States follow with an estimated new investment of $86,300,000, of which about 48 per cent is for steam-electric generating plants. It appears, therefore, that about 57 per cent of the total expenditures for extensions will be made by the companies supplying territory that contains the most intensely industrial sections, as well as the largest cities of the country.

It appears that the additions to the generating equipment of the New England States will be comparatively small during 1922. Twenty-eight of the largest companies of that section reported a proposed increase of only 45,000 kw. in steam-electric generating plants and 29,500 kw. in hydro-electric plants. Last year eighteen companies reported an increase of 65,000 kw. in the steam-electric plants, or 20,000 kw. over the 1922 additions reported by the twenty-eight companies. Whether this is indicative of a surplus amount of generating equipment in the central stations of this section is questionable, but it is significant in view of the fact that during 1921 only 80,000 new residential lighting customers were added to the systems in this section, one of the smallest proportionate increases reported by any section of the country. However, it appears that the extensions to the transmission and distribution systems of the New England States will materially exceed those during 1921.

The figures on the South Atlantic States are based on

TABLE I—SUMMARY OF REPORTS FROM 237 COMPANIES (OVER 2,500 KW. GENERATOR RATING), GIVING ADDITIONS TO GENERATING AND DISTRIBUTING SYSTEMS DURING 1922

Country and Sections	Companies Reporting		Steam-Electric Generating Plants			Hydro-Electric Generating Plants			Total Value of Proposed Additions to Steam and Hydro-Generating Plants During 1922	Value of Proposed Additions to Transmission Systems During 1922	Value of Proposed Additions to Distribution Systems During 1922	Total Value of All Proposed Additions During 1922
	Number	Total Generator Rating Jan. 1, 1922, Kw.	Total Generator Rating Jan. 1, 1922, Kw.	Proposed Additions During 1922, Kw.	Value of Proposed Additions	Total Rating Jan. 1, 1922, Kw.	Proposed Additions During 1922, Kw.	Value of Proposed Additions				
New England States	28	818,176	606,340	45,000	$3,466,000	211,836	29,500	$2,800,000	$6,266,000	$1,612,000	$1,942,000	$9,820,000
Middle Atlantic States	36	1,619,559	1,166,539	287,166	20,745,500	453,020	182,250	3,587,400	24,332,900	9,570,899	8,406,143	42,309,942
South Atlantic States	33	729,339	569,855	40,000	3,610,000	159,484	57,150	1,400,000	5,010,000	2,197,450	2,157,250	9,364,700
North Central States	60	1,412,698	1,158,188	207,630	12,018,244	254,510	26,775	3,381,640	15,399,884	6,416,122	8,793,256	30,609,262
South Central States	32	493,578	411,303	37,750	3,119,950	82,275	0	3,000,000	6,119,950	2,013,850	2,533,245	10,667,045
Mountain States	24	536,577	91,700	8,500	360,000	444,877	0	280,000	640,000	113,254	730,231	1,483,785
Pacific States	24	1,328,969	454,561	46,250	3,651,714	874,408	104,000	23,031,780	26,683,494	18,392,333	18,768,751	63,844,578
Total for United States	237	6,938,896	4,458,486	672,236	$46,971,403	2,480,410	399,675	$37,480,820	$84,452,228	$40,315,908	$43,331,176	$168,099,312

TABLE II—VALUE OF ADDITIONS TO ALL CENTRAL GENERATING AND DISTRIBUTING SYSTEMS DURING 1922 AS ESTIMATED BY "ELECTRICAL WORLD"

Country and Sections	Total Rating of all Generating Plants, Jan. 1, 1922	Steam-Electric Generating Plants		Hydro-Electric Generating Plants		Total Value of Estimated Additions to Steam and Hydro Central Generating Plants During 1922	Value of Estimated Additions to Transmission Systems During 1922	Value of Estimated Additions to Distribution Systems During 1922	Total Value of Estimated Additions to Transmission and Distribution Systems During 1922	Total Value of All Estimated Additions During 1922
		Estimated Additions During 1922, Kw.	Value of Proposed Additions	Estimated Additions During 1922, Kw.	Value of Proposed Additions					
New England States	1,303,825	76,000	$5,870,000	39,000	$3,690,000	$9,560,000	$2,570,000	$3,095,000	$5,665,000	$15,225,000
Middle Atlantic States	3,410,000	332,000	41,250,000	256,000	7,240,000	48,490,000	20,130,000	17,680,000	37,810,000	86,300,000
South Atlantic States	1,707,038	76,000	6,890,000	222,000	10,900,000	17,790,000	5,140,000	5,045,000	10,185,000	27,975,000
North Central States	4,850,959	388,000	34,700,000	78,000	9,800,000	44,500,000	22,000,000	30,200,000	52,200,000	96,700,000
South Central States	1,017,000	78,000	6,460,000	32,000	6,000,000	12,460,000	4,150,000	5,220,000	9,370,000	21,830,000
Mountain States	701,000	20,000	829,000	0	310,000	1,138,000	148,000	955,000	1,103,000	2,241,000
Pacific States	1,549,539	58,000	4,345,000	117,000	25,850,000	30,395,000	21,450,000	21,900,000	43,350,000	73,745,000
Totals for United States	14,539,361	1,028,000	$100,543,000	744,000	$63,790,000	$164,333,000	$75,588,000	$84,095,000	$159,683,000	$324,016,000

estimates to a larger extent than those from any other section, inasmuch as one of the largest generating and distributing companies of that section did not report its proposed extensions. This estimate has been carefully made, however, based on conditions in that section as reflected by reports from other large companies, and the total of $27,975,000 is believed to represent with fair accuracy the value of the extensions in that section during 1922.

The estimated value of extensions to the electric systems of companies operating in the Mountain States totals only $2,241,000. Of this amount 49.2 per cent will be spent for extensions to transmission and distribution systems and 36.9 per cent will go for extensions to equipment in steam-electric generating plants. No new hydro-electric extensions were reported by the companies of this section, and it is believed that no such extensions are contemplated in this section during 1922.

The Pacific States are the only section in which the expansion will fall below that of 1921. Of the estimated total of $73,745,000 to be spent this year, almost 64 per cent will be spent by the Southern California Edison Company and the Pacific Gas and Electric Company. It is estimated that the generator rating of this section will be increased by 175,000 kw. during the present year. There are two projects at present being constructed under a license from the Federal Power Commission which will have an ultimate development of over 690,000 kw. and will cost more than $112,000,000.

A study in detail of the reports submitted as summarized in Table I brings out some rather interesting comparisons. The cost of the proposed installations in steam generating plants during 1921 averaged $56 per kilowatt, while in 1922 it averaged $70 per kilowatt, although the average cost of construction and equipment is now undoubtedly below that of 1921. This apparent inconsistency is probably explained by the fact that several companies this year reported proposed extensions to their stations, such as new boilers, stokers, etc., with no additional generator units. For this reason comparative figures giving the cost per kilowatt for the two years are hardly justifiable. A similar condition exists in the cost of new additions to the hydro-electric plants.

It must be borne in mind that these estimates are for additions to generating and distributing systems which were operating prior to Jan. 1, 1922, and do not include the systems of new operating companies organized in 1922.

Reliability of Radio Shown by Broadcasting Experience

By J. C. MARTIN
Western Editor Electrical World

Experiences Met in the Operation of the Station of the University of Wisconsin Bear on Central-Station Problem—Difficulties Encountered and Experimental Work Necessary

NUMEROUS letters from distant points have testified to the receipt of programs from the various broadcasting stations in the United States. A study of the experiences of the owners of these receiving stations should give an accurate idea of the reliability of the radio telephone at various distances, but up to the present time no careful effort to gather data for the study of this problem seems to have been reported. Early this year, however, Prof. E. M. Terry and M. P. Hanson, who have the active charge of the radio-telegraph and radio-telephone station of the University of Wisconsin at Madison, sent out a questionnaire that was answered by 115 persons who had been operating receiving sets at distances ranging from less than 20 miles (32 km.) up to 250 miles (400 km.). These people dwell in Wisconsin, Illinois, Iowa and Minnesota. The station is heard with fair regularity as far south as Texas, and reports of reception of the market reports and entertainment programs that are broadcasted have come from states on the Atlantic seaboard. The questionnaire was sent at a time when the number of receiving sets was considerably smaller than at present and to persons who were close enough to be directly interested in the market reports of the Middle West and to whom their regular receipt would be valuable. For this reason the analysis of the answers to the questionnaire given here will be of real interest to the central-station operator who may be expecting to experiment with the radiophone as an aid in his work.

Without going into a complete technical description of the station, the principal point of interest to the prospective radiophone user is the amount of power required to broadcast. At the time the questionnaire was sent out the station had been operating with four 50-watt tubes, two being used as oscillators and two as modulators. The antenna input was approximately 100 watts. The circuit used is a slightly modified Heising circuit. Up to a short time before the questionnaire was sent out the operation had been at 800 m.,

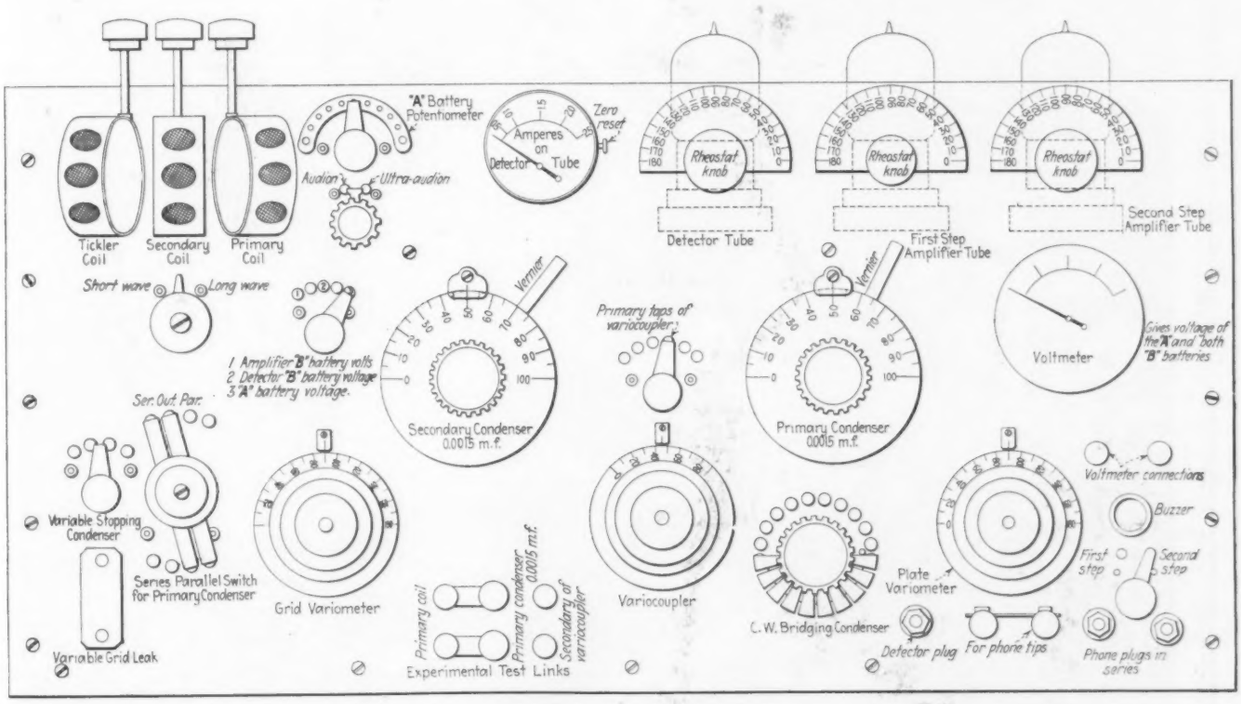


FIG. 1—RADIO-TELEPHONE RECEIVING SET USED BY GEORGIA RAILWAY & POWER COMPANY

Designed for long and short wave reception. Variometers and variocouplers are used for short wave reception and honeycomb coils for long waves. The circuit arrangement is shown in Fig. 2. This apparatus and the transmitting set illustrated in Figs. 3 and 4 are being used in experimental work to determine the feasibility of the radio telephone for interstation communication and direction of field men. Continuity of reception during emergencies is a most important consideration.

Radio Is Weaving Itself Into Every Fabric of Human Life

NO GROUP of pictures can adequately illustrate the extent to which radio telephony has woven itself into human life. However, the illustrations on this page may slightly indicate its ramifications. If some systematic compilation could be made of the receivability of messages by various amateurs, the operating conditions at the time and the equipment involved, the data should be very helpful in improving the reliability of radio communication. A shows Senator New of Indiana participating in a political debate with Senator Beveridge via radiophone, thousands of amateurs listening. B and D show the broadcasting station of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, D being the transmitting apparatus and B a receiving set for checking transmission. C—This vocal and organ recital in New York was heard by passengers on a Long Island Sound steamer 50 miles away and by many amateurs around New York. E shows an army officer directing the training of distant cavalrymen by radio.

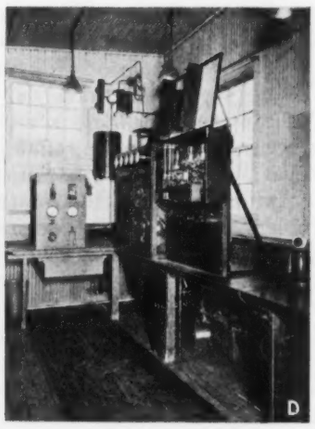
A

© International

B

© Ewing Galloway

C



D

E

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but it was reduced to 485 m. for the market reports and 360 m. for the concerts. This was done to comply with the temporary regulations established by the government when broadcasting became a problem in the radio world. This change in wave length might have been expected to bring out no little comment, and, owing to some of the difficulties universally experienced with the shorter wave lengths, many complaints might have been expected. It is remarkable that only a few were received, and these did not seem to be of serious moment. They will be touched on later in the discussion of the answers to the questionnaire.

The table gives the principal data compiled from the answers. They have been roughly grouped by "miles distance" in an air line from Madison. The types of receivers show whether vacuum tube or crystal detector sets are used and the number of steps of amplification. As was to be expected, three and four steps of amplification are few in number because of the difficulties experienced when audio-frequency amplification is carried beyond three steps. This difficulty is due to the reaction between the various steps, which can be only partly eliminated by extremely careful shielding of the panel and the various steps from each other. The difficulties as well as the expense involved make more than three steps of audio-frequency amplification impracticable for the average amateur at the present time. Radio-frequency amplification has not been sufficiently developed, particularly for the shorter wave lengths, to be a factor in a study of this kind.

ANALYSIS OF TROUBLES REPORTED

The following comments are confined to the radiophone results. In the groups up to 50 miles (80 km.) distant the absence of reported trouble is rather remarkable. Complaints of trouble from those at greater distances are more frequent, but even these are not very numerous. One complaint of the "fading" of the radiophone broadcasting comes from a point about 30 miles (48 km.) distant where a vacuum-tube detector only is used. A station at about the same distance reports faint reception of the broadcasting at 360 m., a vacuum-tube detector only being used. One instance of the slight blurring of words is reported. The interference that might be expected from spark sets on the shorter wave length seems to be rather slight.

In the groups distant 50 to 100 miles (80 km. to 160 km.) one case of trouble was reported due to the hum of the generator at the transmitting station which supplies the plate voltage for the transmitting tubes. This brings up an important point that must be borne in mind at every radiophone station. If filter circuits are not properly arranged to damp out the commutator ripple from the direct-current generator or the ripple from the rectifying device, the proverbial threshing machine will seem a quiet operating device as compared with the racket which will be created in the receiver by the ripple of an improperly designed radio-telephone plate supply. Numerous cases have been noted in amateur radiophone transmission where the ripple in the plate circuit has actually drowned out the transmission of speech. One man in the 50-to-100-mile group complains of interference from the government stations along the Great Lakes. He was using a crystal detector at about 55 miles (88 km.). The form of crystal detector at present in common use is more susceptible to interference troubles than the vacuum tube, a fact that must be remembered in the design of equipment. It is also less sensitive, and, while reception at distances running up to 100 miles is noted in the answers to this questionnaire, the crystal is not ordinarily considered dependable for more than 15 to 20 miles (24 km. to 32 km.). Other complaints of interference from the same source were made.

PRINCIPAL CHARACTERISTICS OF SOME OF THE RADIO-TELEPHONE SETS RECEIVING BROADCASTING FROM THE UNIVERSITY OF WISCONSIN

Distance (Miles)	Number Reporting	Type of Receiver		Amplification				
		Crystal	Vacuum Tube	No Step	One Step	Two Steps	Three Steps	Four Steps
0–20	12	4	8	5	1	6	..	..
20–30	5	1	4	..	2	3	..	..
30–40	12	..	12	5	3	3	1	..
40–50	13	1	12	7	2	4	..	..
50–60	12	1	11	7	1	2	1	1
60–70	9	..	9	6	..	3	..	..
70–80	12	..	12	1	3	6	2	..
80–90	8	1	7	3	4	1	..	..
90–100	12	1	11	5	2	5	..	..
100–150	13	..	13	5	2	4	2	..
150–200	5	..	5	3	..	2	..	..
200–250	2	..	2	1	1	..	..	..
Totals	115	9	106	48	21	39	6	1

In the groups over 50 miles distant there is only one case noted where complaint of irregularity of reception is made. All through the answers run statements that reception is irregular, but these irregularities are due almost altogether to the fact that other duties prevent the individual from listening in regularly. In the list of occupations given thirty-five describe themselves as students. The remainder are scattered among all sorts of occupations, from the banker and business man to the mechanic and laborer. Even the answers from the students show that the market reports which form the most important part of the work of the broadcasting station are utilized in school work or for the benefit of others near by.

Among other suggestions made to better the service was one for improvement of modulation. The writer of this article can testify from personal experience that the modulation at this station is as good as the art yet knows how to make it, and no difficulties in reception

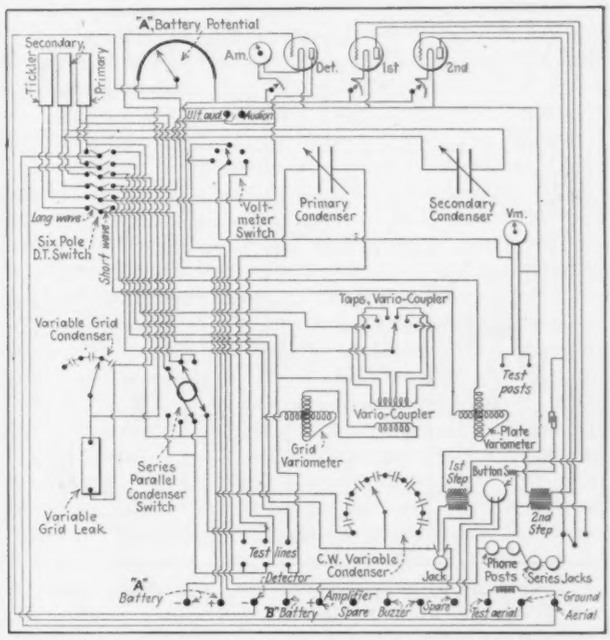


FIG. 2—RADIO-TELEPHONE RECEIVING CIRCUITS (SEE FIG. 1)

are apparent from this source. The suggestion none the less brings up an important point. Imperfect modulation can cause the absolute failure of an otherwise first-class radiophone station. While perfect modulation is not yet attainable, it is possible for such purposes as those which interest the central-station

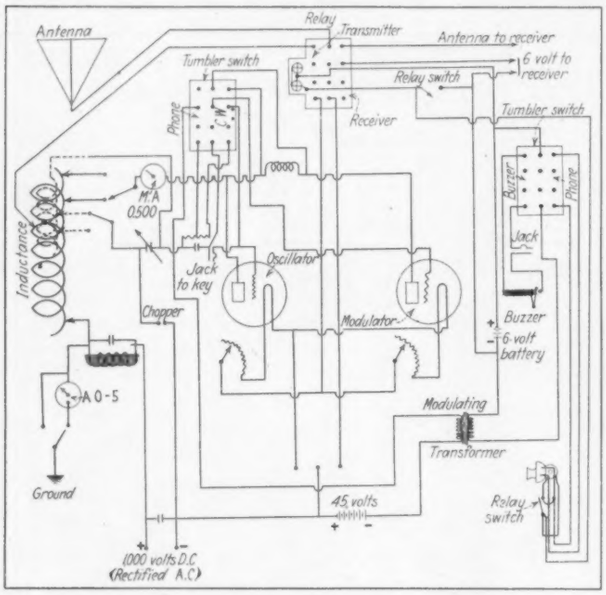


FIG. 3—CIRCUIT DIAGRAM OF 100-WATT RADIOPHONE BUILT FOR GEORGIA COMPANY

Of the two tubes one is used as an oscillator and one as a modulator. The set is also equipped with buzzer modulation and interrupted continuous wave for code work. The arrangement of equipment on panel is shown in Fig. 4.

company to reach a degree of perfection in which the expert technical observer will be the only one to be seriously annoyed by the distortion that cannot be eliminated. It is also well to remember that transmitting apparatus is not the only source of distortion; unless receiving apparatus is carefully designed, it is capable of spoiling the work of the most carefully designed transmitter. In the particular case noted the receiver was equipped with four steps of audio-frequency amplifications. In the present state of the art this is quite likely to be a source of distortion. The same is also true where loud speakers are used, as they may be for some operating purposes. Much remains to be done in developing these devices. So far the phonograph tone chamber seems to be the best of the loud speakers, as well it might be, since manufacturers have spent huge sums of money and much time in its development.

SOME DIFFICULTIES OF RECEPTION

Perhaps the greatest difficulty that is encountered in short-wave reception is the so-called "fading" or dying out of signals, particularly when long-distance reception is involved. The troubles do not seem to occur on the longer waves, some authorities saying that above 500 m. the difficulty disappears rapidly. Rather extensive tests were made by amateurs some time ago in an effort to determine the cause. The tests did not solve the difficulty, and while it seems probable that atmospheric conditions have much to do with the trouble, some recent observations extending over several months indicate that interference from other stations is a contributing cause that grows in importance as the number of telephone transmitting stations increases. In these observations a distant station has been repeatedly picked up when the "fading" of signals took place at intervals. By careful work in every case it has been possible to tune in and detect one or two other stations each of which was heterodyning the others. In some instances, when all but one of the stations has ceased operation, the remaining station is at once picked up. No sign of "fading" has remained. Other experiences with reception from a nearby transmitting station while a distant station was interfering indicated "fading" tendency on the part of the nearby station, although, because of its proximity to the receiving station, the signals were too strong to be completely overridden by the distant station. In radiotelephone work the interference of one radio-telephone transmitter with another may appear in the form of a general blanketing of the transmission of two stations working on the same or nearly the same wave length, rather than be shown by the direct interference by a mixture of signals such as often occurs in telegraphic radio work, particularly when spark or arc stations only are involved. Whatever the condition of the atmosphere may have to do with the trouble, the central-station operator is quite likely to find that the causes outlined above will be present and must be looked out for. A large amount of development and experimental work to minimize these effects as far as possible must be carried out if radio telephony in the service of the central-station company is to be of the maximum benefit. Among the reception difficulties complained of was that of induction from nearby machine shops and a telephone central rectifier. This indicates some of the central-station receiving difficulties that may be met when large generators or other rotating or transforming equipment is near receiving stations.

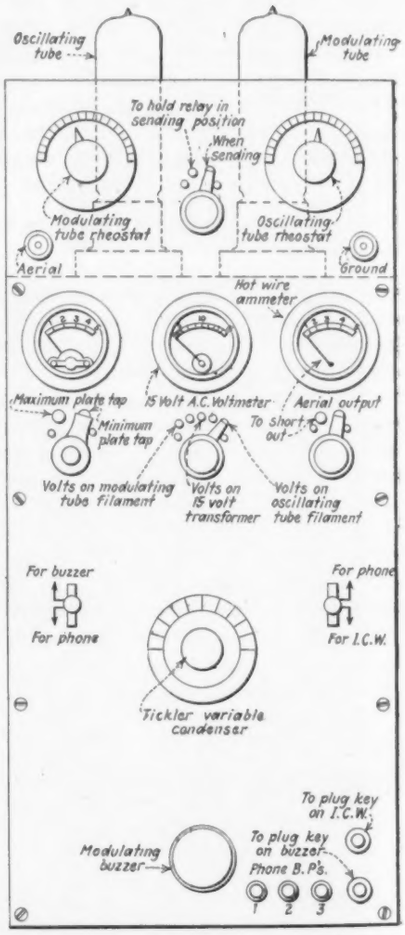


FIG. 4—RADIO-TELEPHONE TRANSMITTING PANEL (SEE FIG. 3)

One fact that is brought out in the experience of the university station in broadcasting market reports is the possibility of arranging code methods of communication that will be effective even under severe atmospheric disturbance. Regular forms on which to copy the

radio market broadcasts are supplied to those who wish them. Each item that is quoted has a code designation. In selecting the code designations words made up of letter sounds that carry well are used. These sounds are those classed as hard, the softer-sounding letters being avoided as far as possible. The code is modeled after government standard practice in these matters, and it has been found that these code words will be copied under circumstances where the actual names of the items would not be understood at all. This points the way toward experiments in getting messages through under conditions that might be otherwise impossible.

In this connection it might be well to remember that, even under the best conditions of modern wire telephony, a surprisingly large part of the conversation of the person at the other end of the line is not understood word for word. This is not due to any defects in transmission or in the telephone plant itself, but to the fact that in the majority of instances the listener has a good knowledge of the subject of the conversation and instinctively avoids the mental effort needed to comprehend and register each word. The effect of this individual trait is more clearly seen when transmission is actually bad but when, notwithstanding, conversations of which only a few words can be caught are understood, because the receiver of the message knows much of what is to be said from previous familiarity with the subject. The same thing is observable in the case of a telephone line on a long high-voltage transmission line. The operators will easily and without serious effort carry on conversations that would be impossible to those who did not know the subjects under discussion. While this way of maintaining communication by radio telephone is not to be recommended as a regular practice, the radiophone is most likely to be called on when all other means of communication have failed and when communication of any kind may mean not only the saving of dollars and cents but perhaps the restoration of a service on which the safety of the community depends.

The analysis of the questionnaire proves little beyond the fact that more than a hundred persons have listened to market reports over a period running for some of them into approximately a year. Distances range up to 250 miles (400 km.). No serious complaint of any character was voiced in the answers. Undoubtedly, as every one who has had experience with questionnaires knows, some troubles were not reasonable. However, it is hardly possible with so many answers that serious difficulties could exist without their being voiced. Though the questionnaire answers no problem definitely, it does give an additional basis for confidence in the reliability of the radiophone for some classes of service, and it suggests some things that need to be taken into account in future experimental work by central-station men.

Credit is due to both Professor Terry and Mr. Hanson of the University of Wisconsin staff for assistance in the preparation of this article. Their hard work has made the university broadcasting station a real factor in the business world of a good many agricultural communities in the Middle West, as well as a source of education and entertainment to scores of people. Credit is also due H. L. Wills, electrical engineer and operating manager of the Georgia Railway & Power Company, for the details of the transmitting and receiving radiotelephone sets which are included in this article.

A Brief Review of Residence Wiring Experience

Selling Wiring at a Fixed Price with Fixed Terms Attracts Customers with Less Destructive Competition

STATISTICS on housing conditions, the number of unwired homes existing at present along established central-station lines and the growing value of a residence customer to an electric light and power company are overwhelming in their evidence that the field for house wiring is tremendous and worth while. But such statistics of opportunity are never so stimulating as actual records of achievement. It is not what can be done but what some one has already accomplished that stirs men to action. There have always been a vast number of unwired houses open to conquest.

There have for years been many thousands of wiring contractors in the country, all of them—until the war time—busily engaged in installing electric wiring. Many central-station companies in co-operation with the local wiremen conducted house-wiring campaigns with good result. Then came the war and a practical cessation of all building construction except for war industries, and the bottom dropped out of the wiring business. Electrical contractors, finding the backbone of their business broken, sought for the means to maintain themselves in the absence of construction work. They interested themselves more largely in appliance selling, began to call themselves more generally contractor-dealers, and let their attention wander from what in former times had been their prime function —the wiring of houses.

WHERE CAMPAIGNS OCCURRED

It is a matter of no little moment, therefore, that in certain cities the business of house wiring during this period boomed. No new houses were being constructed, but the local central station sensed the situation as an opportunity to interest the contractors in the wiring of the already-built residences located along the lines, and by highly organized co-operative effort the message of electric service was carried to the dwellers in these homes and they were induced to wire their houses and enjoy the comforts which electric light and appliances contribute to any household. Within the last few years of war-time and post-war conditions such campaigns have been successfully conducted in Portland, Me.; in Boston, in Hartford, in Brooklyn and New York City; in Philadelphia, Reading, Lancaster, Lebanon and Pittsburgh, Pa.; in Elmira, N. Y.; in Cleveland, Cincinnati, Dayton and Marion, Ohio; in Muncie and Kokomo, Ind.; in Chattanooga and Nashville, Tenn.; in Roanoke, Va.; in Columbus, Ga.; in Cedar Rapids, Iowa; in Barbourville, Ky., and in many other cities. And the fact that in Cincinnati alone, in a period of one year and a half, 25,000 houses were wired and connected to the circuits—this being the period including 1921, when business depression was at its worst—shows to what an efficient and successful basis this job of house wiring has been reduced by organization and what splendid possibilities it offers.

Out of these campaigns there have developed some interesting data and some very definite practice. In the first place, it has been established that the way to sell house wiring is to present it as a definite proposi-

tion at a fixed price and with fixed terms of payment. The average householder fears the plumber and he fears the wiring contractor, for he does not know to what expense the job will run once the work starts. There may be an estimate, but, alas! experience has proved too many times in the popular memory that there may be extras too. This reluctance, this persistent refusal, has been broken down, however, by making an offer at a flat price of so much per outlet, to be paid for so much cash down and so much in a series of easy monthly payments, and Cincinnati and Boston have added a thirty-day free trial offer, which brings much business and costs nothing because no one wants to quit once they have service.

THE PRICE PER OUTLET

In Cincinnati the price for a five-room house complete was $90, payable at $5 a month for eighteen months. In Boston a fixed schedule of prices was offered with a minimum installation of $14.35 and monthly payments ranged from twelve of $2 to twenty of $5. In Brooklyn prices were fixed with a two-dollar minimum and twelve months to pay. In Philadelphia payments were spread on from twelve to twenty-four months. In Roanoke, Va., flat offers ranged from $15 to $27.50, payable 10 per cent down and in twelve installments. In Reading they sold at a flat rate of $4 a room and a flat rate on the consumption. In Columbus, Ga., with fixed prices, 10 per cent was paid cash down and the rest in four months' time. In Lebanon, Pa., the first six outlets cost $19.20 and the remainder $2.60 each, plus fixtures. In Barbourville, Ky., the company gave the labor for wiring free and one month's service and sold all the material at cost. In Hartford no flat price was made, but the lighting company paid the contractor for his job, collecting on a period of twelve months. The details vary, but the principle is much the same in most cases—fixed prices per outlet and twelve months to pay.

In every case apparently the campaign offer has been developed through co-operation between the central stations and the local wiring contractors on a varying basis under which the lighting company assisted to a greater or less degree in the financing of the wiring contracts. By the Cincinnati plan, under which nearly 25,000 houses have been wired, the Union Gas & Electric Company threw the offer open to all contractors, but was finally compelled to assist and establish a single contractor who did the bulk of the work, so great was the demand. The company has financed all the contracts. In Boston at first the contractors were paid in full by the Edison company, but subsequently the financing was put in the hands of a regularly constituted financing corporation, thus freeing the funds of the central station. Moreover, they are now offering a thirty-day free trial in Boston, as in Cincinnati, and agree to pay the customer's net bill less 5 per cent cash discount if the installation is not accepted. The contractor must be able to carry up to $5,000 of partial-payment accounts, and he contributes 2½ per cent of the total wiring bill to a co-operative advertising fund.

In Cleveland the contractors work on a somewhat different plan, under which they receive a commission for soliciting wiring business and assign all money due under the contract to the bank. When the work is complete the bank advances 50 per cent of the value of the job and the contractor gives a note for the full amount. Then, as monthly installments are paid into the bank by the customer, one-third of each payment is credited to the contractor's checking account and the balance to the reduction of the note. This plan also relieves the central station of investment responsibility. In Dayton they used two forms of contract. Under one the contractor financed the plan on a basis of 20 per cent when the contract was executed and five monthly payments. By the other, contracts were secured by the central station and the contractor performed the work for 15 per cent less than the regular schedule of prices. The company offered 5 per cent for cash on completion of the work or allowed twelve monthly installments, with 10 per cent cash down.

In every case the obvious purpose is to help the householder wire his house and to relieve the contractor from the burden of carrying the account. For, naturally, in a big campaign the volume of business exceeds the ability of the average contractor to finance. But the loss involved in these transactions is, by the common experience, almost nothing. In Cincinnati there have been no bad debts. Dayton wired 7,000 houses in three years, with no regrets. Hartford wired 1,200 in a single month, Portland wired 700 in nine months, Chattanooga 3,000 in two years, Lancaster 865 in six weeks, Roanoke 600 in six months, Elmira 1,300 houses in a year, Cedar Rapids wiring contracts totaled $2,500, and the bills have been paid. It has become standard practice to allow 5 per cent for cash, and it is surprising how large a proportion of customers, although easy payments are offered, prefer to pay the bill entire. In Lebanon 90 per cent paid cash. Elmira reported 60 per cent.

REDUCES PIECE COMPETITION

One great advantage of the fixed-price campaign has been proved to be the elimination or reduction of the price competition that has existed to so large a degree between wiring contractors. Too often the householder calls in a contractor and obtains an estimate. He sends for another contractor to get a second bid to check against. The second man asks if he has had any one else figure, proceeds to talk the owner out of this switch or that baseboard outlet, so that the total of his estimate may come below the other fellow's bid, and when the job is done many elements of comfort and convenience have been sacrificed by this misguided, destructive price competition. But this fixed-price campaign offer tends to establish standards and provide accommodations that reduce the tendency toward this kind of price cutting and at the same time provides a larger volume of business and relieves the urgent stress of competition.

Under the influence of a well-organized campaign activity, house wiring also becomes an all-year business under constant process of development. The value of a campaign over the independent work of individual contractors is, in a word, the value of organization in any effort. The Society for Electrical Development has just published a most interesting and suggestive monograph, entitled "Building Housewiring Business," which outlines in detail the steps to follow in working out a house-wiring plan, arranging the basis of financing, developing the "prospect" list and getting the plan into operation. The Joint Committee for Business Development has also issued a guide book on wiring which outlines the important features of many recent campaigns and presents a bibliography of the subject. On both these publications this article has drawn for information.

Operating Interconnected Hydro Plants for Best System Economy

By J. W. ANDREE
Engineer Operating Department, Southern California Edison Company

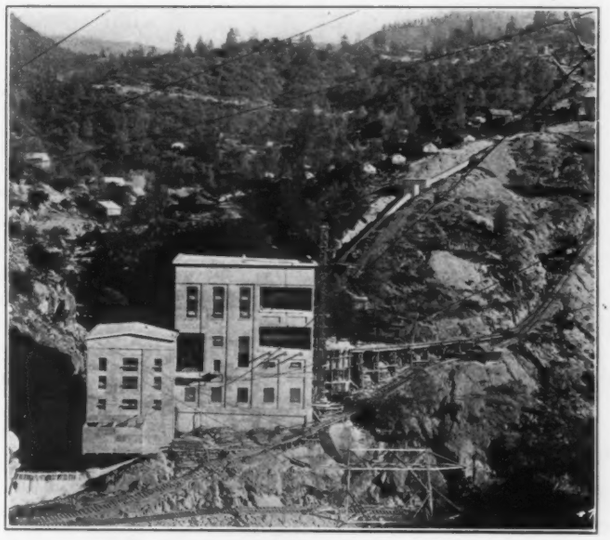
Requires Careful Balance Between Steam Stations, Storage and Base-Load Hydro-Electric Plants—How Southern California Edison System Minimizes Use of Steam Standby

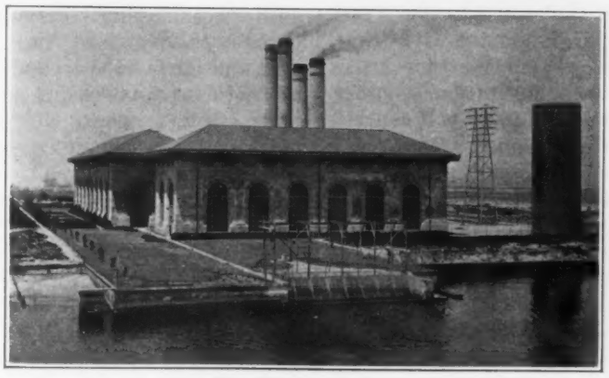
A REDUCTION of the spare generating capacity in operation on the system of the Southern California Edison Company to about 8 per cent of the total load, or the equivalent of one of the largest generating units, has been accomplished without risks to the rendition of service. This is an important factor in the economical operation of the system. Furthermore, this spare capacity is carried in hydro-electric stations rather than steam stations, this being made possible by advantageous arrangements of the hydro-electric stations utilizing storage water. Although the specific means of accomplishing these results are, of course, peculiar to this system, the fundamentals will hold true for other systems.

The layout of the transmission system is of prime importance in insuring a high degree of continuity of service, and in this regard the system of the Southern California Edison Company follows the leading features of correct engineering. All important plants have duplicate transmission lines, generally on separate poles or towers, and all important load centers are fed from two or more directions. The transmission system is capable of separation into two or more parts to facilitate the handling of serious cases of trouble, and the lines are equipped with relay systems which will automatically cut out sections of lines on which trouble occurs.

On reference to the map of the transmission system shown it will be seen that Big Creek plants Nos. 1, 2 and 8 all tie into the 150,000-volt double-circuit line extending in a southerly direction toward the Eagle Rock substation near Los Angeles. At the Vestal substation the double lines from Kern River plant No. 3 are connected to this line. Here also load is diverted to the Mount Whitney system, which is fed from a single 60,000-volt loop line from which any substation may feed from either direction around the loop. The Kern River plant No. 3 is also connected to the Borel plant, situated a few miles down the river. From Borel duplicate lines run south to Monolith substation, from which a single line continues south, furnishing load to Lancaster and finally connecting to the Kern River lines at the Castaic substation. Load on this line may be carried from either direction.

From the Kern River plant No. 1 60,000-volt duplicate lines extend south to Los Angeles. From the Castaic substation a 60,000-volt line extends west to the Saticoy substation, where it is met by another 60,000-volt line which leaves the Kern River line at the San Fernando substation. From the Saticoy substation a double, 60,000-volt line extends to Santa Barbara, thus giving all load in this territory a duplicate source of supply. At the Macneil substation, further south, the Sherman line is connected with the Kern line. This is one end of the 60,000-volt loop line which extends around the city of Los Angeles and feeds into the city from all sides. The first of these feed points is the Culver City substation, which carries all the load in that section of the city and the west coast load. This substation is also fed by a 60,000-volt line from the Eagle Rock substation. From Culver City





FIGS. 1 AND 2—STEAM POWER IS USED ONLY WHEN ESSENTIAL

Energy is normally generated by water power exclusively on the Southern California Edison Company system. Big Creek No. 8, which is the latest addition to the hydro-electric plants, is shown at the top, while Long Beach steam standby plant is shown at the bottom. Operation of steam stations has been reduced to a minimum on this system by careful co-ordination of individual power resources.

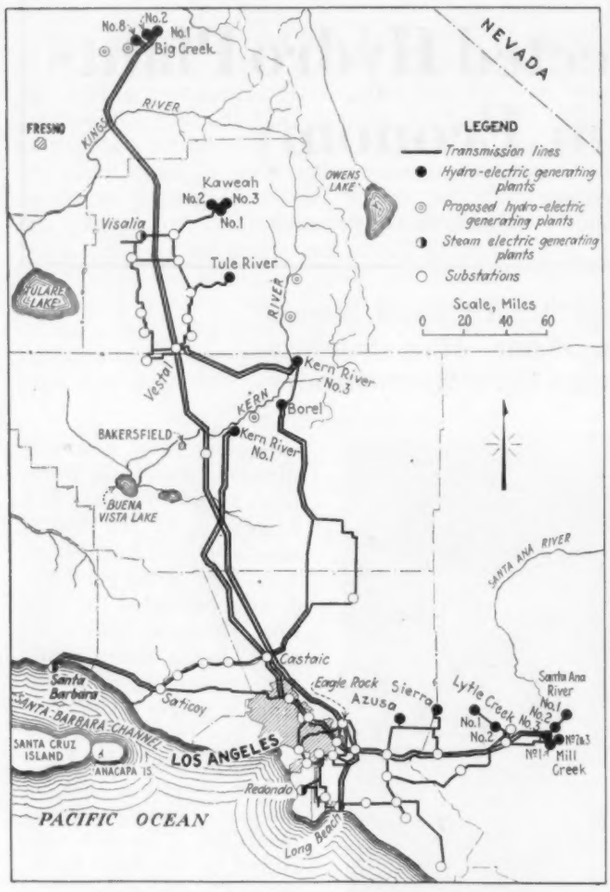


FIG. 3—DUPLICATE SOURCES OF SUPPLY ARE PROVIDED FOR ALL LOAD CENTERS

the loop line continues through Inglewood to the Westflor substation, from which a large amount of railway and industrial load is supplied. From Westflor south is a 60,000-volt line to Torrance substation, another large load center with two additional 60,000-volt sources of supply, one directly from the Redondo steam plant and the other from the Long Beach steam plant. The loop line extends east from Westflor to the Vernon substation, which is in a large industrial center that may also be fed directly from Eagle Rock substation or from taps to each of the Long Beach-Newmark lines which are the main outlets for Long Beach steam-plant power.

From Los Angeles station No. 3, which also has a direct connection to the Eagle Rock substation, the Kern River lines may be considered as continuing east to Colton, the principal load center of the eastern part of the system. At Newmark these lines are intercepted by two lines from the Long Beach steam plant and two from the Eagle Rock substation. This same flexibility of system and duplication of sources of supply is carried out in the remainder of the transmission system.

PROTECTION GIVEN BY RELAY SYSTEMS

The reverse-power and balanced-relay systems which this company has put into service are in a large measure responsible for the low percentage of spare generating capacity that it is necessary to keep in operation. Balanced relays which have been installed on many of the parallel transmission lines are proving very effective in reducing the number of outages due to transmission-line failures. About 80 per cent of the cases of trouble on transmission lines which are protected with such relays are eliminated without interruption to the service. It is believed that this percentage will be even higher after some of the mechanical imperfections of the relays themselves have been eliminated. The reverse-power relays for transmission loop lines are proving very satisfactory in this respect, and in the Mount Whitney territory a complete installation of this nature has just been completed in which eight substations in a 60,000-volt loop are each protected with this type of relay. Many of the large generators are equipped with reverse-power relays which trip out the main unit and the field circuit in case of trouble in the machine itself. This greatly reduces the damage to the generator and cuts down the time required for repairs and getting the unit back into service.

THE GENERATING SYSTEM

The location of steam plants is in most cases subject to some flexibility. They should be near the load center or where the railway facilities and fuel, boiler-feed water and cooling-water supply are most advantageous. These conditions are met in both the Redondo and Long Beach plants of this company. The units in these plants were installed at intervals over a long period, and hence in each are embodied different features of design. As a consequence these units are given preference in operation inversely with their age. These plants, being at different locations, feed into different parts of the transmission system; hence interruptions which affect one are sometimes not felt by the other at all.

Although the locations of the water-power plants of this system are, of course, fixed, there is some flexibility in the design and in the water-storage facilities. Many of these plants are built on streams where there are no facilities for annual storage of water. Usually on such streams daily storage of water is not permissible, because the water of these streams is used for irrigation and during the irrigating season the full discharge of the stream is needed at all times. Hence it is not permissible to cause fluctuations in the natural flow of the stream. Plants operating under this restriction have been designated as base-water plants to distinguish them from plants where storage of water is possible, such as the Big Creek plants. Huntington Lake reservoir is of a capacity sufficient to store the full annual discharge of Big Creek, the stream upon which it is located, and permit of this water being used as desired at any time during the year through all of the Big Creek plants.

Big Creek plant No. 1, which takes its water directly out of Huntington Lake, has a capacity of 32,000 kw. At the tailrace of this plant is a small reservoir which permits of daily storage of the water discharged. Big Creek plant No. 2 takes its water directly from this small reservoir. Advantage is taken of the water storage to make the capacity of plant No. 2 50 per cent greater than that of plant No. 1, thus providing capacity for regulating and for carrying peak loads, besides spare capacity. At the tailrace of the No. 2 plant is another such reservoir from which plant No. 8 takes its water. Similarly, plant No. 8 has a larger water capacity than plant No. 2, allowing it to draw on its storage in the same way as the latter. During the period of non-peak these intermediate reservoirs are filled, and they are drawn on during the peak-load period or are held as reserve capacity.

With the regulating reservoirs, annual storage and steam plants available, the next problem is to operate this combination of plants to obtain the maximum annual efficiency. The base-water plants usually operate at full load from about March 1 to Aug. 1. From precipitation records and past operation the power available for the rest of the year can be fairly well estimated by April 1, at which time the inflow into Huntington Lake starts. At this time the water level in this reservoir must be at its lowest permissible value.

If at this time precipitation records and snow surveys indicate that the inflow into the reservoir will not be sufficient to fill it, the inflow is carefully conserved and the most economical steam units are operated in preference to using water from the reservoir. If the records indicate that the reservoir will be filled, or if there is any probability of its overflowing, as much water as possible is used out of the reservoir and the steam load is reduced to a minimum.

Numerous small streams discharge into Big Creek below Huntington Lake. These have their maximum-flow period at the time of the inflow into the lake. This water is diverted into the small storage reservoirs at the forebay of No. 2 plant and is used through plants No. 2 and No. 8. During a large portion of the season the flow of these small streams is sufficient to operate plants No. 2 and No. 8 at full load, and the small regulating reservoirs are put to good use to regulate the daily fluctuations of the stream flow and the demands for power. Very little use is made of plant No. 1 at this time except for reserve capacity or in the way already mentioned. Shaver Lake reservoir, on Stevenson Creek, which has a present storage capacity of 6,000 acre-ft. (720 hectare-meters), normally discharges into the main stream below power house No. 8, but has been diverted into the regulating reservoir for power house No. 2. This reservoir is at the present time not large enough to store the accumulated flow of Stevenson Creek, hence some water must be withdrawn from it during the run-off period to prevent overflow. At the beginning of the run-off period it is always the intention to have this reservoir at a low level so as to avoid the necessity of withdrawing too much water from it. At the end of the run-off period, which is about June 15, when it is definitely known how much power

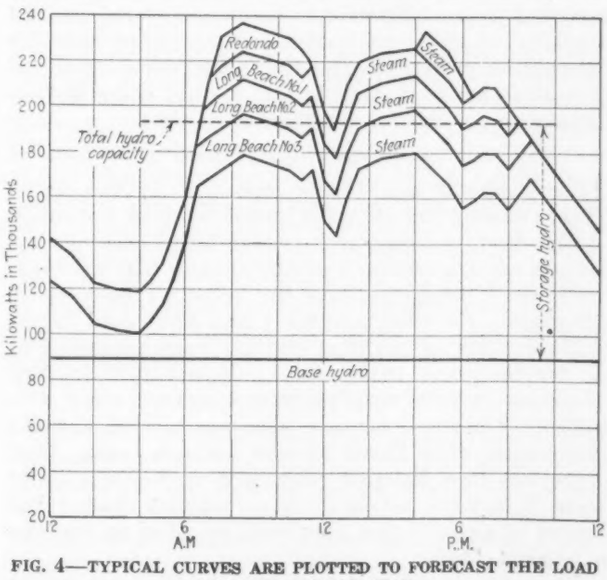


FIG. 4—TYPICAL CURVES ARE PLOTTED TO FORECAST THE LOAD FOR THE COMING YEAR

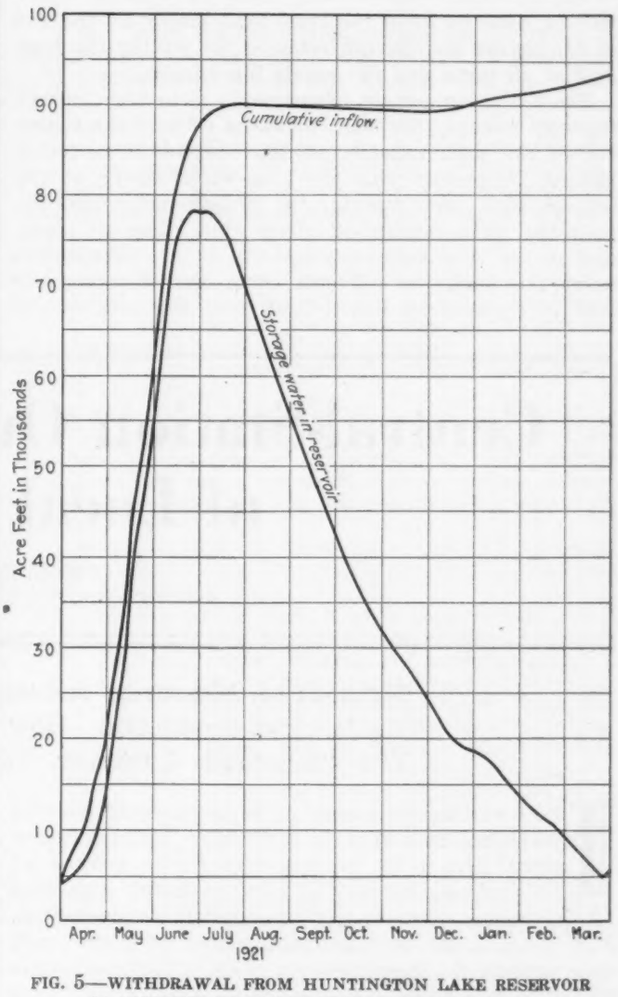


FIG. 5—WITHDRAWAL FROM HUNTINGTON LAKE RESERVOIR IS ADJUSTED TO EMPTY IT BY THE BEGINNING OF THE INFLOW PERIOD

will be available from Huntington Lake and when also a very close estimate can be made on how much will be available from the other water-power plants, the problem of the most economical use of the power available is ripe for solution. From studies of past records the load for the coming year can be very closely estimated. Characteristic daily load curves, such as are shown herewith, are plotted, one for each month of the year. These curves are made by taking an actual daily load curve of the same month of the past year, the integrated area of which when multiplied by the number of days in the month will give the actual kilowatt-hour output for the month. These curves are then divided into their component parts. The lower area of the curve represents the power available from base-water plants. This area is readily determinable. The area directly above the base-water area is the storage-water power available. The determination of the amount to be carried each month by storage water is not so simple. From a purely financial viewpoint it is advisable to draw heavily on the storage water at the first of the season and defer fuel bills until later. The total area of the curve above the base-water power represents the storage-water power plus the steam power. The problem is then to determine the amount of steam power to carry each month to insure that the most economical steam units will carry the bulk of the steam generation and that enough storage-water power

will be used to leave the reservoirs empty at the end of the season and enough retained for pulling the peak load at all times and for regulating purposes.

The first requirement of operation is to have enough capacity to carry the load; hence on each of the twelve curves the peak capacity of the sources of power is plotted, beginning with the base-water power at the bottom, then superimposing the storage-water capacity, then the most economical steam unit, then the next, and so on until sufficient capacity is in operation to carry the load. At off-peak times the storage-water load is replaced by steam load until the area of the storage-water curve represents the total kilowatt-hours available from storage water. This steam area is then apportioned to the various units and plants according to their economy of operation.

The withdrawal of storage water may be varied or shifted from one month to another in order to produce better operating conditions, and considerable time is spent on this problem to obtain the best possible operating schedule. Sometimes variations in load conditions during the year make it necessary to make slight changes in the operating schedule, but such changes are not objectionable.

Central-Station Output a Barometer of Local Industry

By G. E. MILLER
Sales Manager Cleveland Electric Illuminating Company

Methods of Measuring Industrial Output — Power the Best Yardstick of Production—How Cleveland Bankers Regard It—The "Hundred Customer Index"—Interpreting the Curve

IT IS well known among experienced engineers and manufacturers that in a shop or manufacturing plant driven by electric power the volume of finished product may be very accurately measured by the amount of electricity consumed in its production. For instance, the experienced manager of a steel mill can translate the kilowatt-hours of electricity used in his mill over a definite period of time into tons of steel rolled for the same period with surprising accuracy. He is able to do this because the electricity used represents work done in making the finished product.

So in almost any line of manufacture where electricity is used for power, and where data are available over a sufficient period of time, the output of the plant may be accurately measured by the kilowatt-hours of electricity used.

In a large industrial center such as Cleveland, where electric power supplied by a central station is used almost universally to drive the wheels of industry, it is possible to judge very accurately the relative amount of finished products made in that community during any period of time by comparing the total amount of electricity generated by the central station in that period with that generated in some other period.

Statisticians have learned to collect data of various kinds and from various sources and, after proper evaluation, to put the results into tabulation or graphic form and thus depict business conditions past, present or future. For this purpose data on bank clearings, payrolls, street-railway traffic, post office receipts, building permits, real estate transfers, freight tonnage, etc., have been used.

POWER THE BEST YARDSTICK

Outside of the three large steel mills in Cleveland, a very large percentage of the power used in its factories and commercial activities is supplied by the Cleveland Electric Illuminating Company. It follows, therefore, that a study of our load curves, representing the total kilowatt-hour output, may be of value as indicating the trend of business.

It seems superfluous, except for purposes of comparison, to point out that the bank clearings of a particular day or week do not measure fairly the productive capacity of industry for that period, as obviously they may reflect business done by selling goods from stock when the plant producing the goods is completely shut down. Many other factors enter which make the dollar an untrustworthy unit of measure with which to gage the industrial output of the community for any particular period.

On the other hand, kilowatt-hours generated today measure the work done today and, consequently, goods produced today. Electricity cannot be stored up and used out of stock, so to speak; there is no time lag between its production and use. Electricity generated in a given period of time is also used in doing work—making goods—in that same period of time.

SHOWING THE BANKERS

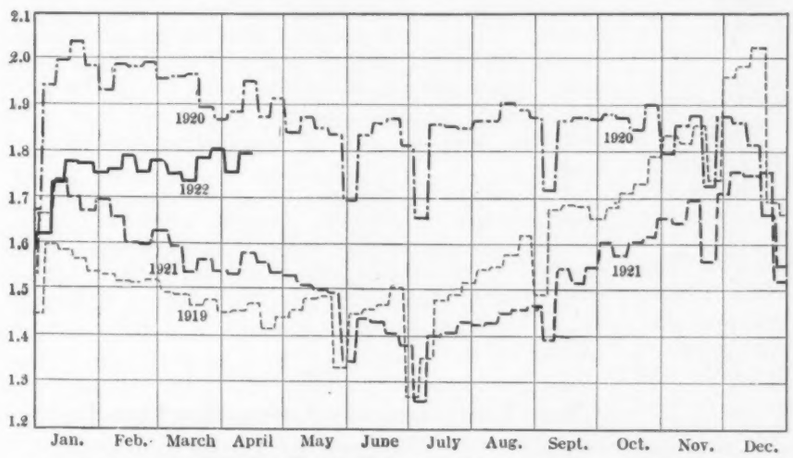
Some months ago I was requested by the Union Trust Company, which is the largest banking institution in Cleveland, to appear at one of its board meetings and present our load curves and similar data that we might have which would indicate the trend of business in Cleveland. For that purpose I had some load curves prepared showing the total kilowatt-hours generated by us for the years 1919, 1920, 1921 and 1922 to date. These curves were made up on tracing cloth about 4 ft. square. The curve for each year was plotted, showing the average daily kilowatt-hours for each week. Each curve was in a different color, with each curve drawn about $\frac{1}{8}$ in. wide and put up on an ordinary shade roller, housed in a box so that they could be rolled up just like a window shade.

By means of these large curves, which were put up

on the wall, the bankers in attendance at the meeting got at a glance the variations in total power generated by us during the periods in question. A comparison of one curve with another showed the difference between any two periods of time, and by explaining briefly what these curves mean and that the kilowatt-hours generated indicate work done in some form at the particular time these data became of the greatest interest. After these curves were shown to one of the vice-presidents of one of our largest banking institutions, who ranks as one of the leading statisticians in the country, he made the statement to me that in his judgment they were the best barometer of Cleveland's business that he knew of.

THE HUNDRED-CUSTOMER INDEX

In addition to that set of curves, which is reproduced here, I had another set prepared, which, for want of a better name, we call our "hundred-customer index." These curves are made up in the same way as the others and are made from the kilowatt-hour consumption of a hundred of our largest consumers who use our power for their entire requirements and who have been using it for a number of years. These hundred customers are considered by us as a fair index of Cleveland's commercial and manufacturing industries, and therefore the fluctuation in their use of electricity is a splendid barometer of actual production for the periods covered by the record. The variations in the "hundred-customer index" are followed with the keenest interest by these groups of business men, and I am now supplying this information to the Union Trust Company weekly and to the Cleveland Chamber of Commerce monthly. The Chamber is sending out to its members various data on business conditions made up in the form of curves and graphs, and the information which we supply to them is included therewith.



A FOUR-YEAR PICTURE OF THE USE OF ELECTRIC POWER IN CLEVELAND

This curve, showing in terms of weekly periods the gross output of the Cleveland Electric Illuminating Company expressed in millions of kilowatt-hours, with a comparison of four years, is furnished by this company to the financial men of Cleveland as a barometer of local industry. Through the Chamber of Commerce it is also provided to all member business men who are interested.

INTERPRETING THE CURVE

This curve on total output has been reproduced with the following interpretation of its significance as a barometer of local business in the May issue of *Trade Winds*, the monthly house organ of the Union Trust Company. It indicates the manner in which I have translated the load fluctuations to our bankers and business men:

In this chart the total kilowatt-hour output from the Illuminating Company's plants is plotted for the years 1919, 1920, 1921 and 1922 to date. The figures on the vertical line at the left represent total daily kilowatt-hours generated, and the curves, for simplicity, have been plotted by weeks on the basis of daily averages. Each small horizontal line in a curve represents the daily average of kilowatt-hours for one week. For instance, the daily average for the last week in October, 1920, was 1,900,000 kw.-hr., and that week is represented by the short horizontal line in the curve for 1920.

A glance of these curves will show considerable variation throughout the year. This variation in load is very noticeable in the curves for the years 1919 and 1921. These two curves are characteristic of central-station load curves and show the effect of longer summer days when less electricity is used for lighting.

The 1919 curve, beginning the first of July at about 1,300,000 kw.-hr. per day, rises steadily throughout the remainder of the year to a maximum of over 2,000,000 kw.-hr. per day by the middle of December, when it drops sharply. This drop is due to factories closing down for the holidays.

After Jan. 1, 1920, the curve rises again to a maximum of approximately 2,040,000 kw.-hr. per day for the third week in January.

The 1920 curve as a whole is not a characteristic curve, as it drops less than normal as midsummer approaches, and beginning Nov. 1 it drops sharply to the end of the year, which is also an abnormal condition. The whole curve for 1920, however, shows clearly that an abnormal business condition prevailed throughout that year.

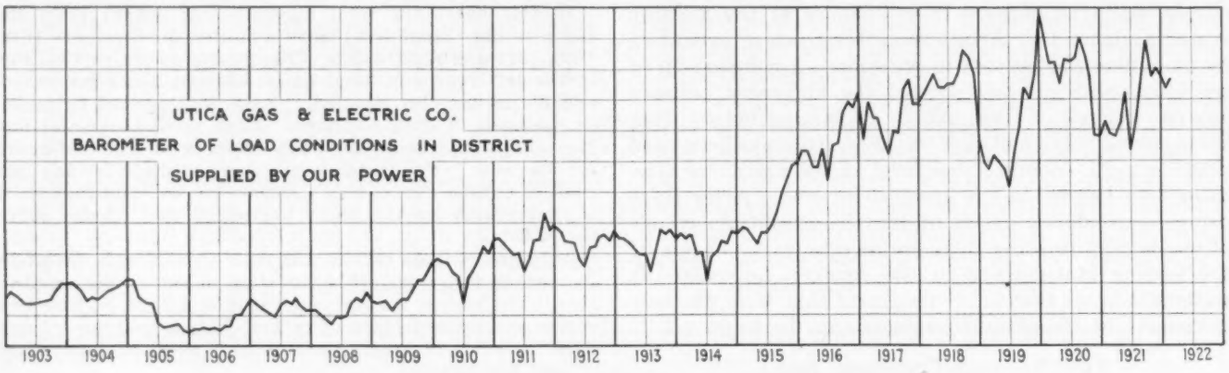
By 1921 we dropped back in industrial activities, and the curve for that year indicates about the normal seasonal variations.

The interesting part of this chart, however, is the curve for 1922 up to date. This curve starts at the beginning of the year, rising sharply to about 1,775,000 kw.-hr. per day during the second week in January, and from that point the trend is almost horizontal across the sheet—quite contrary to what would be expected under normal conditions of business.

In comparison with the 1919 and 1921 curves we should have expected the 1922 curve to drop about the middle of January, but instead it fluctuates up and down, with the trend horizontal. Now there has undoubtedly been a proportionate reduction in the use of electricity for lighting since the middle of January, 1922, due to longer daylight, similar to that indicated by the 1919 and 1921 curves, but for some weeks prior to the end of March shops and factories of all kinds were using more electricity for power purposes because they were running longer hours and putting additional machinery into production. This in turn means the employment of more men and, consequently, the output of a greater volume of manufactured product for the whole community.

In other words, business in Cleveland is improving. The chart says so and the kilowatt-hour meter indulges in no guesswork—it records facts.

I believe that in all the larger communities where the central-station company has taken its proper place in supplying the needs of the homes and the industries for electric service there would be a ready welcome on the part of banks and business institutions, as well as wide-awake chambers of commerce, for such data as this depicting the fluctuation of load on the central-station plants from time to time. It seems to be an opportunity for the central station to render a very practical service, which will be greatly appreciated.



A TEN-YEAR GRAPH REFLECTING BUSINESS GROWTH IN UTICA

The Utica Gas & Electric Company has prepared a curve which pictures the trend of power consumption in Utica over a period of ten years, and this has been distributed to all the leading local business men. It is extended each month and the new complete curves are sent out, so that it is possible to follow the fluctuations of industry in terms of electric power.

Utica Barometer Curve Sent to All Business Men

A Chart of the Load Curve Is Carried in a Continuous Graph That Is Made Available to All Local Business Interests

BY E. P. PECK
General Superintendent Electrical Department
Utica (N. Y.) Gas & Electric Company

IT HAS long been in my mind that it would be a practical benefit to the community to use the central-station load curve as a barometer of local business conditions. My idea is that business men in a community can use to advantage and will appreciate information which shows the actual business conditions in their community at the moment, with a comparison between present business conditions and those in the past. There is no indicator of business conditions which is more accurate than the central-station company's load curve in the particular district it embraces. The load curve does not follow the changes in general business activity, but changes instantaneously with the changes in activity in local manufacturing. Therefore the central-station load curve is a true barometer of the existing business conditions in the community.

There is, of course, one feature in connection with the use of central-station load curves which should be kept in mind, that a group of large customers may be transferred from isolated-plant to central-station operation. This would show an increase in business on the load curve but would not represent an increase in the community activity. Increases of this kind, however, are generally of small magnitude compared with the total business and have a rather small effect on the load curve. If a load of this kind is picked up which is large enough to have an appreciable effect on the load curve, a note can easily be made on the chart to explain the apparent increase in business.

Our plan, which was put into effect last month, is to send to the business men and bankers in Utica and its vicinity a copy of two curve sheets which are reproduced here. One of these shows the load curve by months from 1903 to 1912 inclusive, the other the load curve by months from 1913 to April, 1922, inclusive. Each point on this curve shows the average daily kilowatt-hours per month. It is our intention to bring the second curve up to date each month and mail copies to those who indicate that they are interested in it. We have purposely left the figures off the scale which show the total amount of load carried, as we believe they are not essential to a proper use of the curve, and these figures might be used for purposes other than that intended.

It has been suggested that it would be well to split the curve up into commercial, industrial and residence curves. This is not possible, however, in our system, as our residence lighting load and our general small power consumers are all on one group of circuits, each circuit carrying both lighting and power load. We therefore have no way of segregating the different loads.

It is doubtful whether this would be possible on most systems. I question, however, whether it is important anyway, for the reason that the element which represents the lighting load is not particularly susceptible to rapid fluctuations and the influence of the season on lighting can be interpreted as it influences the general curve.

New Tungsten Arc Lamp Has One-Point Source of Light

A NEW type of tungsten arc lamp giving virtually a point source of light has been developed recently by the Philips Glowlamp Works of Enidhoven, Holland, the smaller sizes of which are now ready for the market. It is a lamp particularly adapted for projection, microscopy and general laboratory use.

In this lamp, for which patents have been asked, an arc discharge takes place between two small tungsten spheres in an atmosphere of a rare gas. In order to insure the striking of the arc a third electrode is mounted in the terminal glass midway between the feed wires. This electrode is connected through a high resistance to one of the lead-in wires. The material and form of this third electrode have been chosen in such a way that a glow discharge sets in first between it and the electrode next to it, thus starting the discharge between the tungsten spheres.

The distance between the spheres and the glass wall may be very small (2 cm. to 2.5 cm.), so that an optical condenser with a short focal distance can be used where the lamp is applied to projection purposes. A funnel-shaped screen is provided, on which the evaporated and sputtered tungsten is deposited in order to prevent the blackening of the bulb. The lamp has the advantage, it is claimed, that it can be run on a 220-volt alternating current circuit, and except for a series resistance, no auxiliary apparatus is necessary.

Business Conditions in the Electrical Industry on the Upgrade

By ROBERT M. DAVIS
Statistical Editor Electrical World

Electrical Industry as a Whole Is Operating Only Slightly Below What Would Have Been the Point of Demand if Growth Had Been Normal

BUSINESS conditions in the electrical industry are decidedly on the upgrade. This statement applies not only to the industry as a whole, but also to each of its three main branches—the electric light and power, the electrical manufacturing and the electrical merchandising.

Conditions in the electrical industry are distinctly more favorable than in the industrial world in general, and probably more favorable than can be found to exist in any other primary industry. The electrical industry has a large advantage over other primary industries in that it is essentially one exhibiting continual growth even under conditions of extreme general industrial depression. Moreover, the drop from the high point of business prosperity as recorded in March, 1920, to the low point of business depression of July, 1921, was materially less than that experienced in the industrial world taken as a whole. And because the electrical industry has this big advantage over virtually all other industries, indications point to steady improvement and an early return to near normal conditions.

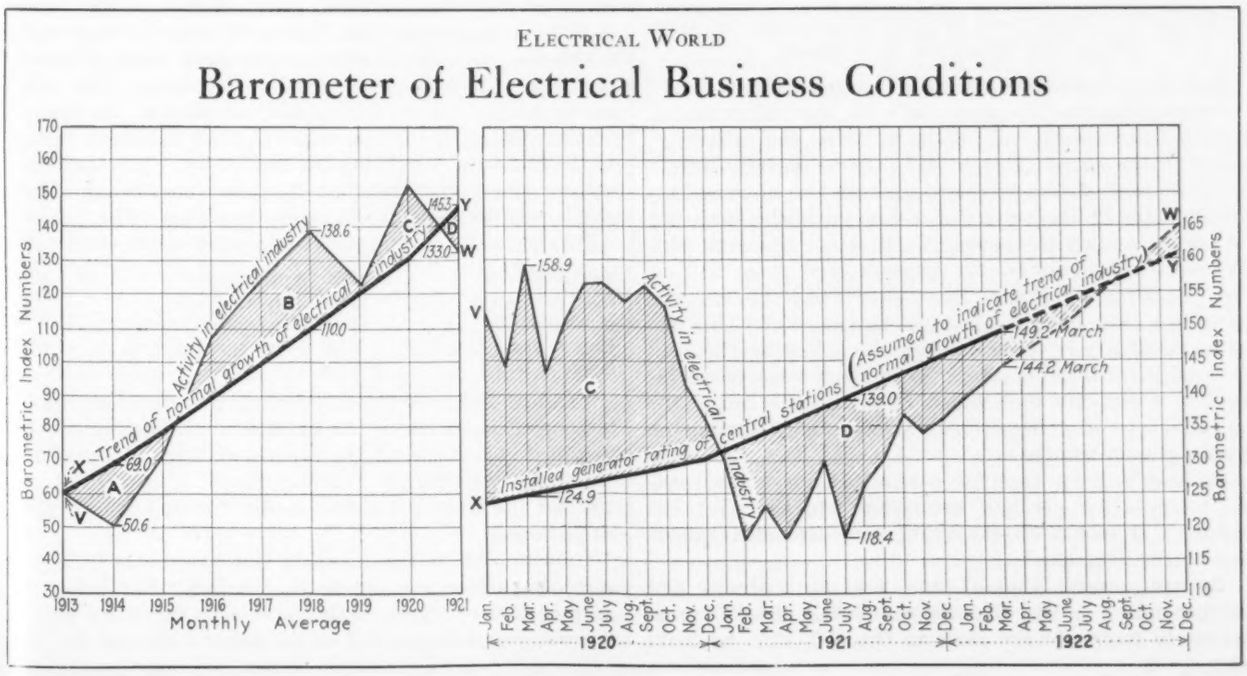
After careful study and consultation with various authorities and prominent statisticians, the ELECTRICAL WORLD has evolved a "Barometer of Business Conditions in the Electrical Industry," extending from 1913 to the present. This "barometer" is reproduced below and will be continued monthly. It is believed these curves indicate quite accurately conditions existent in the industry.

The basis for them is believed to correlate with conditions in the industry and to present accurately any outside influence affecting it. The method used in obtaining the curves is explained at the end of this article. It is not claimed that this barometer is the best or most reliable possible, but it is believed to be the best barometer obtainable with the data available at the present time.

Probably the most reliable and scientific barometer of general business conditions is that presented weekly by the Babson Statistical Organization. The Babson barometer, or "Babsonchart of American Business Conditions," will be used as a basis when comparing business conditions in the electrical industry with those in all industries taken as a whole.

MARCH, 1920, THE PEAK

The "ELECTRICAL WORLD Barometer" indicates that the highest point of activity in the electrical industry was reached in March, 1920, when a reading of 158.9 was recorded on the barometer index scale. Immediately following this record activity came a sawtooth series of fluctuations, tending to decreased activity and reaching



the low point in July, 1921, when 118.4 was recorded on the barometer index scale, making a total drop of 40.5 points. The line showing the "trend of normal growth in the electrical industry" was crossed in January, 1921.

The electrical industry took an abrupt upward turn in July, 1921, and at no time since that date has a decreased activity been recorded with the exception of November, 1921, when probably all industries of the country experienced a slump in activity following a spurt in October. In March of the present year the electrical industry was operating at 144.2 on the barometric scale, or only five points below normal as indicated by the line *X-Y*, or "trend of normal growth in the electrical industry." The line of normal growth has been extended through December, 1922, and the line of activity in the industry has also been extended on the basis of past performance and certain unusual conditions existing at the present time, such as the coal strike. The indications are that the line of activity in the electrical industry will cross the line of normal growth during August of this year and that by the following October the industry as a whole will be producing at the same rate as during March, 1920, which was the month of record productivity. In other words, by next fall the electrical industry will have regained all the business lost since March, 1920, and will be rushing forward for new records in electrical energy output, volume of manufactured electrical machinery, apparatus and supplies, and electrical merchandising.

Some very significant comparisons can be made between business conditions in the electrical industry and conditions existing in American business as a whole, as shown by the "Babsonchart." During 1921 there was a drop in the net gain or growth of American business totaling about 33 points on the barometric scale of the "Babsonchart." On the other hand, during 1921 the "trend of normal growth of the electrical industry" showed a gain of about 15 points on the barometric scale of the "ELECTRICAL WORLD Barometer," and the gross income of the electric light and power industry during 1921 was $61,650,000 in excess of any previous annual income.

COMPARATIVE CONDITIONS IN ELECTRICAL INDUSTRY AND AMERICAN BUSINESS AS A WHOLE

Babson believes that the area on the "Babsonchart" corresponding to the area "D" on the "ELECTRICAL WORLD Barometer" will be the same as the area "C," although the shape of area "D" may be entirely different from that of area "C," and that the size of these two areas on the "Babsonchart" for general business should be approximately the same. Such is not the case with the electrical industry. It appears that area "D" on the "ELECTRICAL WORLD Barometer" will undoubtedly come to a close before it is equal to area "C." This unusual condition is probably brought about by the continuous growth being experienced by the electrical industry, a circumstance which is not at all comparable to conditions in general business, especially during the past eighteen months.

Babson believes that for general business the readjustment is not yet half completed. In the electrical industry it would appear that readjustment is about two-thirds completed.

Babson asserts that if the general business plot corresponding to the ELECTRICAL WORLD plot "D" continues to work upward close to the *X-Y* line, he looks for another dip and expects the area to be prolonged over a longer time than would be the case if the readjustment were more intense. The "ELECTRICAL WORLD Barometer" does not indicate such conditions for the electrical industry. Its continuous growth should eliminate all chance of a decided dip in activity, at least until the next downward turn in the business cycle.

HOW THE "ELECTRICAL WORLD BAROMETER" IS COMPILED

By "electrical industry" are meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

Without doubt the most reliable barometer of business conditions in the electrical industry would be one based on reports of monthly operations of electrical manufacturers, electrical merchandisers and electric light and power companies. Such reports are not available at the present time with the exception of reports from the electric light and power companies. It is necessary, therefore, to turn to sources outside the electrical industry and to base the barometer of business conditions in the electrical industry upon the influence which conditions in these other industries exert on the activity in the electrical industry. The big problem in such a procedure is in arriving at a proper weight for each of those basic industries as regards its influence on the electrical industry.

The primary industries used as a basis for the activity curve of the electrical industry must be those which exert a primary influence upon it. Nine primary industries have been adopted as follows: Textile operations, iron and steel production, mining, paper and printing, glass, vehicles for land transportation, lumber, brick, and food manufacture. The Department of Commerce gives monthly index figures for each of these industries.

The industrial survey being conducted by the ELECTRICAL WORLD and *Power* has been drawn upon in weighting these industries in regard to their influence on the electrical industry. In this countrywide survey to ascertain the extent to which electrical energy is being used by the industrial plants of the country, over 80,000 questionnaires have been sent to the larger establishments. Complete returns have been received from practically all the important industrial states. The estimated horsepower of the motors installed in the plants of the various industries named above has been taken as the basis for weighting the industries. This includes motors run by central-station energy as well as those run by energy generated by private plants. The following weights have been given to the nine basic industries:

Textiles	7.59	Automobiles	1.72
Iron and steel	17.68	Lumber	2.28
Mining	6.88	Brick and cement	3.70
Paper and printing	2.55	Food	4.67
Glass	3.70		

The line *X-Y*, or "trend of normal growth of electrical industry," is based on the growth in the rating of the installed generators of the central stations of the country. By multiplying the barometric index scale by 100,000 the total generator rating for any month may be obtained.

Care must be taken in using this barometer if incorrect conclusions are not to be reached. For instance, assume that in March of this year activity in the industry was registering 144.2 on the index scale, and for the

same month the "line of normal growth" read 149.2 on the index scale, or that the industry as a whole was operating at 5 points below the "line of normal growth." If, then, in April the industry was operating at the same rate as in March in respect to the "line of normal growth," it would not register 144.2 on the index scale, but, say, 146.2, because during April the industry had grown two points on the index scale. In other words, the ordinate between the "line of normal growth" and the line of activity in the industry indicates the extent to which the industry is operating in excess or under the point of normal demand as indicated by the "line of normal growth." In March, 1920, the industry was operating at 158.9 on the index scale, 34 points above the "line of normal growth." In August, 1922, the barometer indicates that the industry will again be operating at 158.9, but such an activity will be entirely normal, since the "line of normal growth" by this time will have reached 158.9 on the index scale. The industry must, therefore, be producing at such a rate if the normal demand for electrical energy, apparatus and supplies is to be fully met.

How Should the Public Utilities Be Financed

By H. M. ADDINSELL
of Harris, Forbes & Company

Relation of Cost of Money and Allowable Rate of Return to the Construction and Extension of Properties, and the Necessity of a Liberal Rate to Make Financing by Junior Securities Attractive

ACCORDING to reliable compilations, the electric light and power companies' new construction during 1921 totaled $214,000,000, and it is estimated that during 1922 $324,000,000 will be needed for additions, improvements and extensions. This enormous amount of new capital will have to be obtained from the investing public. What are the terms upon which that public—the real "financial interests" owning the public utilities—will make this large additional investment in the electric light and power business, and what assurances will it require as to the ability of these companies to earn a fair return on the capital invested in them?

These are questions that are not susceptible of definite determination, but they perhaps offer an interesting field of speculation. We know, however, that interest rates are lower now than they were a year ago. The average yield to the inventor of new utility bond offerings during the first quarter of 1922 was less than 6½ per cent, as compared with nearly 8 per cent for the first quarter of 1921. We also know that utility commissions and courts throughout the country have recently rendered decisions recognizing 8 per cent as the reasonable rate of return that utilities should be allowed to earn in order to make their securities attractive to the public. Interest rates may, and they probably will, go lower, but at the prevailing rates does an 8 per cent permissive return afford a practicable basis for raising the large amount of money that will be required this year by the electric light and power companies alone?

Financing Through Stock Sales

In approaching this question the obvious fact must be borne in mind that no corporation can long or safely operate on borrowed capital alone. Experience has demonstrated that, generally speaking, not more than approximately three-quarters of the required capital can conservatively be expected from mortgage bonds. Inevitable discounts reduce to a lower percentage of the actual cash requirements the amount of cash actually realized by a company from the sale of bonds. The bondholder, furthermore, must be assured of the ability of the company to raise through the sale of junior securities the required balance; else both he and the company are in the position of having built a bridge that only reaches three-quarters of the way across the span of the company's requirements, a bridge that must be completed or it will fall of its own weight. If the bondholder, who is a mortgage creditor, can be interested today in, say, a 6 per cent return, preferred stock, the holder of which is a partner in the enterprise—a partner with a preferred position, but still a partner sharing to some extent the risks of the business—will have to be offered at about 7 per cent to find purchasers; and on what terms will the common stock be attractive to prospective purchasers who will take the last position in all the risks of the business? Bearing in mind that whatever rate of return is granted it is merely permissive, and not guaranteed, it is obvious that the common-stockholder will have to have at least the possibility of a materially higher return.

Stability of Operation a Factor

The public utility business is one of the great paradoxes of the business world. No matter how bad general conditions may be, the utilities usually seem to go ahead, showing a sustained volume of business and frequently actual increases in both gross and net earnings. People do not stop using electric lights, gas stoves, trolley cars and telephones during hard times. Fuel gas and electricity for power are essential to so many and such varied industries and businesses that the aggregate demand for these products shows comparatively little falling off, even though conditions in many individual industries are distinctly unfavorable.

These statements are substantiated by a comparison recently made of the earnings of 112 utility companies for the twelve months ended Oct. 31, 1921 (a period of acute industrial depression), which shows an increase of 8 per cent in gross and 11 per cent in net over the combined earnings of the same companies during the generally prosperous year ended Oct. 31, 1920.

On the other hand, periods of marked industrial activity and expansion frequently bring problems for the utilities. This was particularly true during the tremendous industrial activity of the war and the years immediately succeeding. As has been pointed out many times, the business of the utility companies is not static. They must increase their service to keep pace with the growth of the communities they serve. This necessarily involves the raising of additional funds. These additional funds must come eventually from the investing public. Investors want the assurance of the ability of the company to charge rates that will produce a reasonable return on the investment. This was the difficulty the utilities were laboring under during the war. Operating for the most part under public supervision, they were unable to raise their rates rapidly enough to keep pace with the increasing costs of providing their services because the various regulatory bodies controlling the rates did not respond immediately to the changed conditions. In the meantime their operating expenses were mounting. Labor and material costs were far above pre-war levels and were still rising. The demand for new capital both for governmental and industrial purposes was so wide and so insistent that money also was commanding "wages" above anything that had been known since the years succeeding the Civil War. Industrial companies met the situation by charging higher prices for their products, but as this solution was not automatically possible for the utilities, the result was inevitable. Unable in many cases to make the extensions and additions necessary to handle the increased demand, the quality of the service declined to a point commensurate with income.

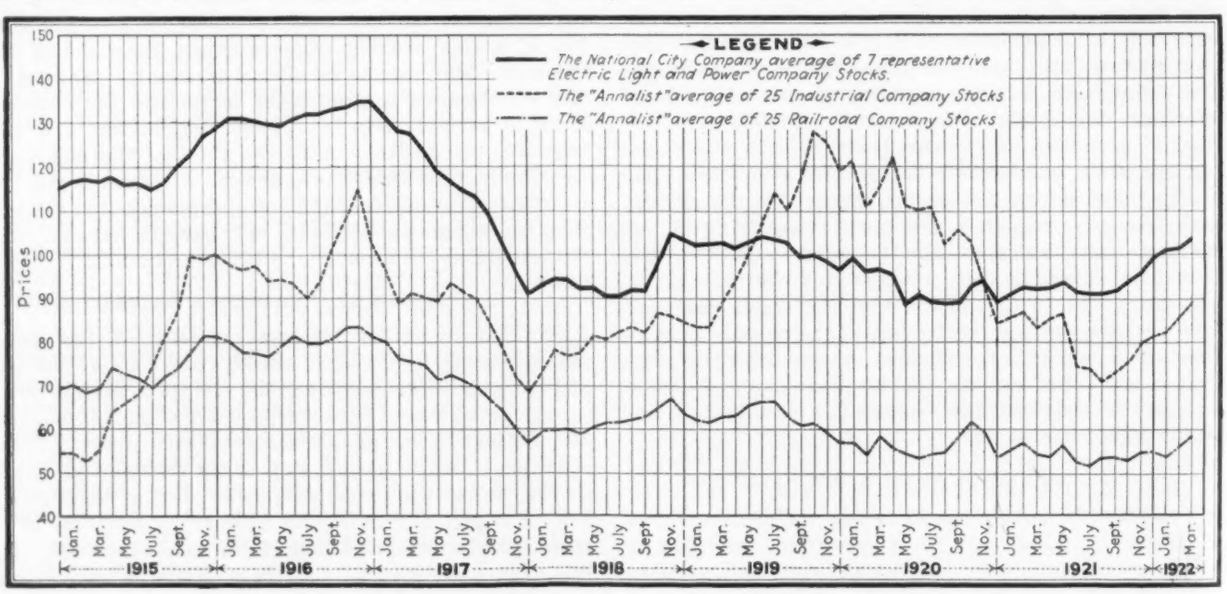
Before long, however, the regulatory authorities recognized the justness of the demands for increased rates and such increases became a general rule, particularly among the electric light and power companies. Allowance was made not only for the increased cost of operating, but also for the increased returns which were the rule on all new capital investments and which the utilities would have to meet if they were to obtain capital in competition with other industries. Wider and wider recognition was given to the principle that companies operating under public supervision should be entitled to earn a fair return on the capital actually invested in their properties.

While the matter of what is a fair return on a public utility property is one that is not susceptible of definite determination to cover all cases, on account of its involving so many variable factors, at the same time it would seem that, generally speaking, under the present conditions an 8 per cent return should be a reasonable one and this belief is corroborated by numerous recent court and commission decisions.

Upward Trend in Price of Light and Power Stocks

Fluctuation of Common Stock for Several Years Past Was Only About One-third That Which Industrial Stocks Exhibited

A STUDY of the stock market brings out the fact that public utility securities form the one group of issues which stands out today in distinct favor. The only possible exceptions to this statement are the state and municipal government issues. The reasons for this upward trend in the popularity of utility stocks with the investing public are not far to seek. One of the essentials of a good security is that its value shall not be materially affected by conditions existing in other industries. Electric light and power corporations were the first to feel the greatly increased industrial activity during the war period, and they were the first to adjust themselves to meet this greatly increased business. The post-war industrial depression found this industry with a materially decreased manufacturing load and the necessity of finding a market for its surplus



MATERIAL INCREASE IN PRICE OF ELECTRIC LIGHT AND POWER STOCKS DURING MARCH

electrical energy. The manner in which this was accomplished is clearly shown by the fact that 1,001,700 new residential customers were added to the central-station lines during 1921, and that the gross revenue of the industry as a whole during 1921 was $944,400,000, or $61,650,000 in excess of the former record revenue of 1920.

Through the courtesy of the National City Company we are able to show a diagram of the average prices of the common stock of seven representative electric light and power companies by months for the past seven and one-quarter years. To the diagram have been added curves showing the prices of twenty-five industrial and an equal number of railroad stocks. So far as possible, the electric light and power stocks represented are of companies doing a purely lighting and power business, and, with one exception, companies engaged in more than one utility activity have not been included in the tabulation. In order that the curves may be comparable, the values plotted have been obtained by averaging the high and low sales of each month.

It will be observed that the total fluctuation of the electric light and power stocks based on the percentage of the range to the low during the past seven years has been only about one-third that of the industrials and considerably below that of the seasoned rails. The fact that the electric light and power stocks have not been subject in the past to such sudden and violent fluctuation as industrials—as indicated in the accompanying curve—is a proper basis for believing that there is no cause for alarm in the fact that electric light and power stocks show a less rapid increase in price at this time when compared with prices of industrial stocks.

The prices of electric light and power stocks are now about the same as during the six-month period immediately preceding the close of the war. There is, however, a material intrinsic difference. The trend in the price of these stocks is now essentially upward, as is indicated by an increase of 2.48 points during March, whereas at the opening of 1919 and immediately following that period the price trend was distinctly downward.

The enviable position now occupied by stocks of electric light and power companies is the result of a better understanding of public utilities by the general public. The doctrine of customer ownership, which is being spread by the sale of utility securities in the territory served, is one of the fundamental reasons for this better understanding. The direct result of customer ownership is a more complete understanding by the community at large of the necessity of rates affording adequate compensation to the utilities and a deep-seated influence upon the state utilities commissions for just regulation. The realization of the absolute necessity for a continual supply of electric energy both for lighting and power has brought public attention to the electric light and power industry as never before. This interest of the public not only as customers but as stockholders has created a feeling of mutual confidence which is being reflected in the price of electric light and power securities.

Systematic Inspection Scheme for Preventing Breakdown

By ALEX. E. BAUHAN
Superintendent of Stations, Pennsylvania Water & Power Company, Baltimore, Md.

Involves Specific Written Instructions with Chart Schedules—Makes Inspection Automatic and Reduces Supervision — Provides Visible Record of Condition

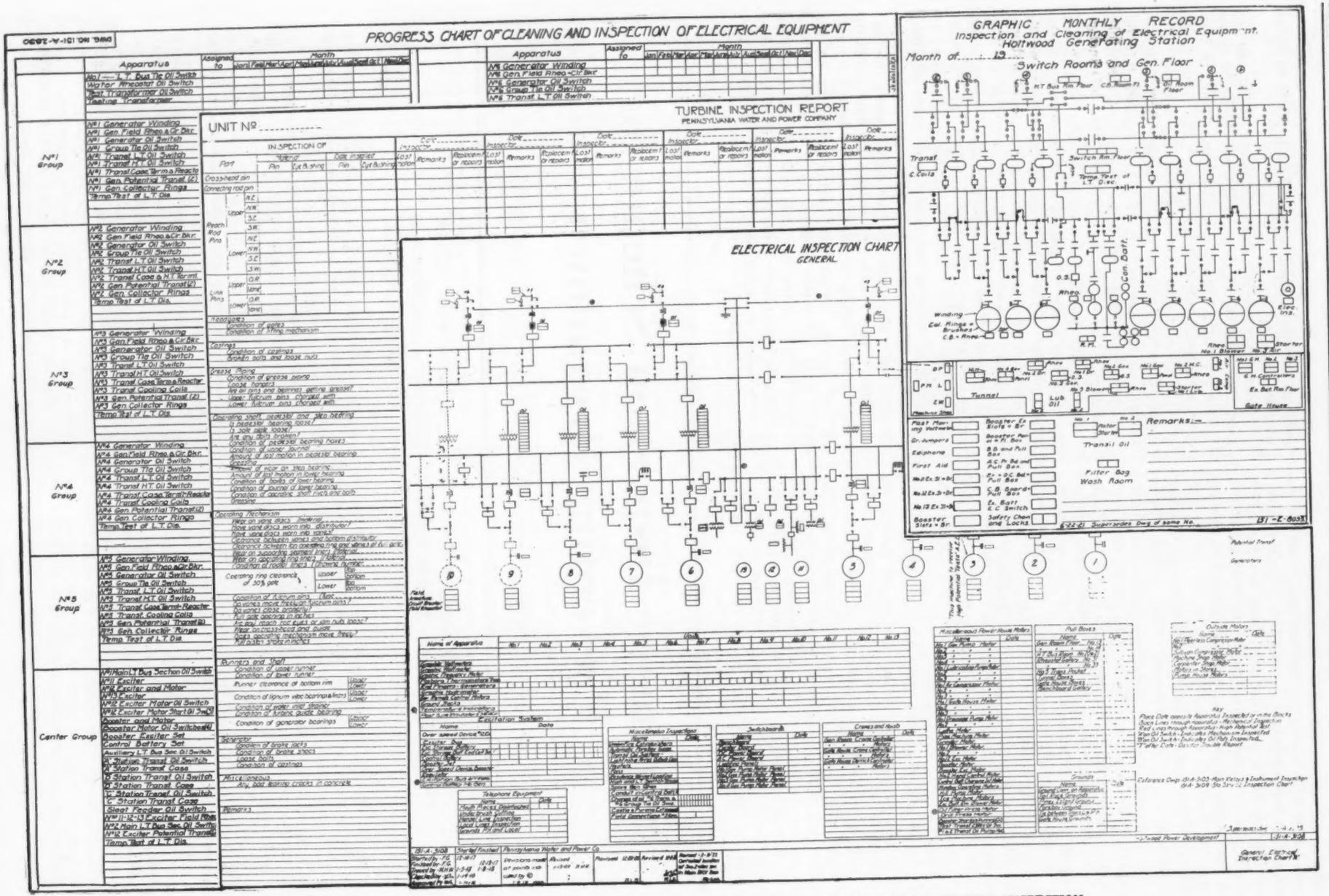
THE desirability of a plan of inspection and correction of minor defects before they develop into breakdowns, causing serious damage to equipment, interruption of service or injury of persons, hardly needs advocacy. Indeed, it can be said that to a certain extent this is the practice in all well-operated plants. However, it is believed that the inspection method here described has some advantages over the procedures more commonly used.

The scheme submitted has been successfully applied in several stations for the past six or seven years and has justified itself not only by a considerable saving in maintenance expense but by a reduction in the number of service interruptions due to apparatus breakdowns to a point far below what might have been expected if the plan had not been in operation. It is a plan which is applicable not only to electrical machinery but also to steam and hydraulic equipment, not only to power stations and substations but also to industrial plants. In fact, it can be applied to the inspection and maintenance of any kind of property. Briefly the plan is:

1. To establish the inspection requirements by written instructions. These instructions tell what inspections are to be made, how they are to be made, enumerate in detail the various tests, observations and measurements required, and specify tolerances of maladjustment or wear.

2. To assign definitely the inspection work to certain persons and to give all of the operating attendants a share in the responsibility for regular inspection.

3. To establish a system of scheduling and progress charts on which every piece of apparatus in the station is listed and which shows the responsibility for each inspection and the periodicity of the inspection. These charts provide space for a record of the inspection having been made and by whom it was made.



FOUR SAMPLES OF RECORDS MAINTAINED BY PENNSYLVANIA WATER & POWER COMPANY IN SCHEDULING INSPECTION

Perhaps the plan can best be elucidated by explaining its operation in a particular application, that of the 83,000-kw. hydro-electric station of the Pennsylvania Water & Power Company at Holtwood, Pa. In the first place, a very complete set of maintenance and inspection instructions has been issued. These instructions will not be referred to further except to say that they tell in detail how the apparatus is to be inspected, what is to be looked for and what precautions are to be observed.

ASSIGNMENT OF INSPECTIONS

The work of making the inspections is assigned partly to the operating attendants and partly to the electrical and mechanical inspectors. The entire equipment of the station is divided among the operating men, each having a certain assignment of apparatus which he is supposed to inspect periodically, keep clean and in proper operating condition. If the apparatus suffers from lack of proper attention, the man who is responsible for this particular piece of apparatus is called to account. If it is kept in exceptionally good condition, it is he who receives the credit. Framed copies of a list of the apparatus and the attendants to whom it is assigned are posted in various parts of the station. In this way the work is equitably divided, and the less industrious attendant is not able to shift his work on the more industrious. The operating men are provided with tools and are permitted and encouraged to take care of the bulk of the minor repairs. Only such work as they cannot take care of is turned over to the regular maintenance men.

While the operating men make the majority of the routine inspections, it is necessary that some of the apparatus shall have a more thorough inspection once a year. These inspections are made by the electrical and mechanical inspectors. The electrical inspector also makes, for instance, monthly transformer-oil breakdown tests, semi-annual relay inspections and calibrations, annual high-potential tests on all station equipment, and inspections on miscellaneous apparatus such as meters, switchboards, signal systems, telephone systems, fire extinguishers, station grounds, cranes and hoists.

In some stations the making of inspections is noted by an entry in the station log book or in a card-index system, or a report of each inspection is made on a printed form which is filed away. Such methods are awkward and lack visibility, accessibility and other advantages which suggest themselves in the following method.

A system of white print charts has been developed on which is provided a place for every item of equipment to be inspected. The charts for recording the operators' inspections are separate from those used for recording the inspectors' work. The charts show clearly to whom the inspection is assigned, indicate whether the inspections are to be made monthly, quarterly, semi-annually or annually, and provide a place for recording the date of the inspection and the initials of the man who made it. These charts are posted on a display fixture readily accessible to the men who are making the inspections so that their progress is continually in view.

Following are features of the principal inspection charts in use, some of which are illustrated in the accompanying figures:

Progress Chart of Cleaning and Inspection of Electrical Equipment.—This chart refers to the periodic inspections made by the operators and covers practically all of the major equipment, including generators, transformers, oil switches, reactors, buses, switchboards, batteries, motors and safety equipment. It is apparent from this chart, for instance, that No. 1 generator potential transformers are inspected quarterly and that No. 1 generator collector rings are inspected monthly. A glance down the sheet at any time shows strikingly whether the inspections are being kept up to date or not and which, if any, has been missed or delayed. Subsidiary to this chart are a number of minor monthly letter-size charts, such as a one-line wiring diagram known as the "Graphic Monthly Record" which the operators use for planning and scheduling the taking out of apparatus and recording the progress of its inspection from day to day during the month. The entries on this chart are transferred to the main chart at the end of the month.

Electrical Inspection Chart "A"—General.—This chart is used by the electrical inspector, and instead of being arranged in a tabular form as in the preceding, it makes use of the station one-line wiring diagram on which the various entries are directly made. This is feasible because most of the inspections made by the inspector are annual. When the inspector completes the inspection on an oil switch the date and his initials are noted in the rectangle representing the oil switch on the diagram. When a bus has received a mechanical inspection a black line is drawn alongside of that bus. When it has had its high potential test a red line is drawn alongside of the bus. This makes it practically impossible for the inspection or test of any part of the equipment to be overlooked. The bottom of this chart provides space for all the miscellaneous inspections covered by the inspector.

Electrical Inspection Chart "B"—Main Relays.—This chart is used by the electrical inspector for the recording of relay inspections and tests. It consists of the lightly drawn one-line diagram of the station on which the relays have been indicated in heavier lines. The relay connections are not shown, but simply the relay itself, and it is identified by its location. Alongside of each relay is a rectangle, divided into as many parts as there are inspections in the year, for noting the date of the inspection and initials of the inspector. Relay settings are not shown on this chart nor is any record made of the setting as found. The normal relay settings are shown on a similar but separate diagram which shows all relay connections and which is one of the permanent records. If the inspector finds the setting correct, no other report is made except the entry on the relay inspection chart. If the relay was found in error, a trouble report is made out and the relay corrected.

Electrical Inspection Chart "C"—Station Service Relays.—This chart performs exactly the same purpose as the foregoing one except that it applies to the relays on the auxiliary equipment in the station and not to the main power relays.

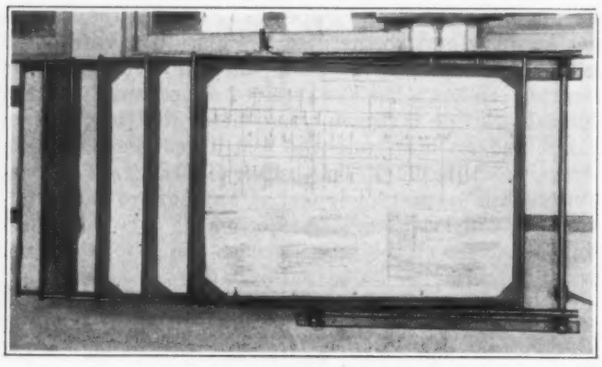
The foregoing charts take care of the entire electrical end of the station. A similar system of charts has been worked out for the hydraulic end which will not be described at this time. It should be mentioned that none of these charts is of any permanent value. At the beginning of each year a new set of prints is put up, and then of course no further reference is made to the old ones.

All of the foregoing charts have been worked out on the assumption that when a piece of machinery is inspected it is found to be either right or wrong. If it

is right, the entry is made on the chart with no explanation whatsoever and no other report is made out. If it is wrong, the letter "T" accompanies the entry and a trouble report is made out. It might be said that none of the equipment is permitted to deviate from its normal condition. If an inspector discovers that deviation has taken place, it is corrected and brought back to normal.

TURBINE INSPECTION REPORT

However, the situation with regard to the hydraulic turbines is somewhat different. These turbines involve a large number of operating-mechanism parts which are submerged in the corrosive water of the wheel pit and subject to a progressive deterioration or wear and which cannot conveniently and economically be kept in perfect condition. The wear and deterioration must be permitted to progress to that point where it is economical to replace the parts, and yet it must not be permitted to progress so far as to interfere with the output of the unit or to endanger its continued operation. This is a situation which exists not only in hydraulic plants but in steam plants and industrial establishments whenever there are several similar units consisting of a large number of detailed parts requiring inspection and maintenance and where the units are not continuously accessible. In such cases it is difficult to form a comprehensive picture of the condition of all the various details of the units. This is a serious handicap if it is necessary to lay out a maintenance or overhauling program for a year or two in advance or if the time or money available for repairs is limited.



SWINGING FRAMES MAKE INSPECTION CHARTS READILY ACCESSIBLE

The scheme referred to below eliminates these difficulties and makes it possible to decide quickly and accurately on what units and in what parts the time or money available can best be spent, as well as to predict what maintenance attention will be required for several years in advance. And yet it is simple and can be explained in just a few words.

It involves the use of what are known as turbine inspection reports, of which there is one for each turbine. In the left-hand column of the chart is listed each of the seventy-odd turbine parts which it is desired to check up. Note is made of the material of which each part is made. The instructions for turbine inspection call for numerous detailed measurements of lost motion, clearances and wear and for observation of the general condition of each of these parts. The inspections are made semi-annually and are recorded in successive columns on the charts. The enumeration of these various measurements and observations prevents their being forgotten. Instead of conditions being reported in vague general terms, specific measurements are called for. The plan also provides a means for recording the many detailed changes which are made in the equipment, thus showing that a certain bushing in one unit is bronze and in the other unit is steel, or that the diameter of a pin in one unit has been increased from 4 in. to 5 in., or that standard piping was used here and extra-heavy piping there. It records experience where details differ. In short, it provides a convenient, graphic, accurate and comprehensive record of the condition of the various parts of the units in a way that could not possibly be accomplished if dependence was placed on some one's memory or judgment of results.

In order to give a good picture of the comparative condition of the units, each chart, in mounting it on the display fixture, is folded back and overlapped on the next so that only the column recording the last inspection of each turbine is visible. We have then at a glance the relative state of repair of each of the machines and can intelligently make comparison of the behavior with the different designs of details and lay out repair programs far in advance.

These charts have been an important contributing factor in cutting down the labor required in overhauling a turbine from twenty to thirty men for thirty to forty days once every three years to a matter of about fifteen men for twenty or twenty-five days once in six or seven years.

USE OF TROUBLE REPORTS

Reference has been made to the filling out of a trouble report in case an inspection shows that the apparatus is not in its normal condition. This trouble report becomes authority and instruction for the maintenance force to repair the equipment and restore it to its normal condition. When the job has been completed, record is made on the report of what caused the trouble, how it was corrected, what was done or what should be done to correct similar defects in the future, and any other details about the repair which might be of permanent interest. These reports play an important part in any preventive maintenance scheme for the reason that by them it is possible to keep a watch on the effectiveness of the station inspection and maintenance procedure. When extensions to plant are contemplated, reference to these trouble reports makes it possible to eliminate design defects in the new equipment.

The identical inspection methods outlined in this article cannot, of course, be applied in every case, but the general principle of using definite written instructions with chart schedules is possible of wide application. It makes inspection more a matter of automatic simplified routine and reduces the amount of supervision required to give that assurance that everything is being checked up properly. It provides a readily visible record of maintenance and inspection conditions in a manner which cannot be accomplished by the more generally used card index systems. It gives the men who work by the system a feeling of more businesslike administration which naturally results in carefulness, thoroughness and more businesslike execution of the work laid out. It actually anticipates and prevents expensive breakdowns and the more or less immeasurable consequences of interruptions to service. In short it pays.

A Review of Experience in "Home-Electric" Demonstrations

No Demonstration of This Kind Anywhere Reported as Unsuccessful—The Popularity of the Exhibits Has Been Great in the North, South, East and West

"HOME-ELECTRIC" demonstrations have proved themselves so successful as a medium of publicity and so profitable as an instrument for increasing the sales of house wiring and domestic appliances that the idea has taken strong hold of the industry. The pioneering period has apparently been passed and "home-electrics" are being organized today in many cities East, West, North and South by co-operative organizations representing the local electrical families in cities of all sizes.

The first "home-electric" demonstration was staged so long ago that the records do not show who the father of the idea was. There was one in Brooklyn twelve or fifteen years ago. Boston established one soon after. There have been many in the meantime, and it is impossible to give a list that is complete. In recent years, however, "home-electrics" have been featured to the public in Boston and Lawrence, Mass.; Utica, Long Island City and Brooklyn; Toronto, Hamilton and Montreal; Baltimore; Columbus, Ga.; Nashville; Fort Smith, Ark.; Louisville and Lexington, Ky.; Cleveland, Canton, Lakewood, Toledo and Columbus, Ohio; Chicago and Milwaukee; Denver and Boulder, Col.; Salt Lake City and Ogden, Utah; Spokane; Portland, Astoria and The Dalles, Ore.; San Francisco, Sacramento, Oakland and Los Angeles. At present they are actually getting ready for "home-electric" demonstrations in Pittsburgh, Atlanta, St. Louis, Dayton, Syracuse, Detroit and Seattle. They are planning to hold them in Centralia, Wash.; East St. Louis, Ill.; Omaha, Poughkeepsie, Galveston, Birmingham, Elmira and Buffalo. They have also been reported from Worcester and Cambridge, Mass.; Albany, N. Y.; Charlotte, N. C.; Jacksonville, Fla.; Cincinnati, Akron, Lorain and Sandusky; Indianapolis and Fort Wayne; Bloomington, Ill.; Wichita, Kan.; Minneapolis, Chattanooga, Nashville, Oklahoma City; Kansas City, Mo.; Boise, Idaho; Provo, Utah; Bellingham, Everett, Aberdeen, Walla Walla and Tacoma, Wash.; Chehalis, Corvallis, Medford and Yakima, Ore.; Stockton and Long Branch, Cal.

THE "IDEA" WELL ESTABLISHED

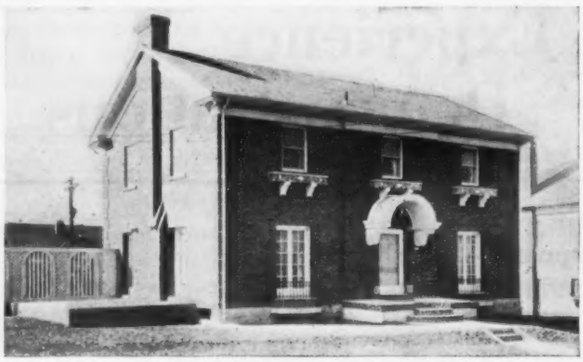
Clearly the idea of the "home-electric" has become established, and the reason is not hard to find. It provides an opportunity not alone to exhibit a complete equipment of electrical household appliances but to show them in a house, surrounded with all the atmosphere that makes a home—furniture, draperies, complete equipment and all comforts ready for living and no diverting duplication of appliances—just a normal home completely electrified. And because it is just a simple home it becomes a matter of neighborhood and community interest and the people come in great numbers. And when they come they can be greeted comfortably and pleasantly in a personal way, conducted through the home in small groups and informed in detail by carefully balanced lectures of all the benefits of modern electric service. Moreover, because these "home-electric" demonstrations are developed by the local dealers and contractors working in co-operation with the central-station companies and local manufacturers and jobbers—all the electrical interests—they become invaluable influences for binding the family more closely together, and, no sales being made in the home itself, the increased local demand for appliances that inevitably results proves profitable to all and makes the enterprise a paying one.

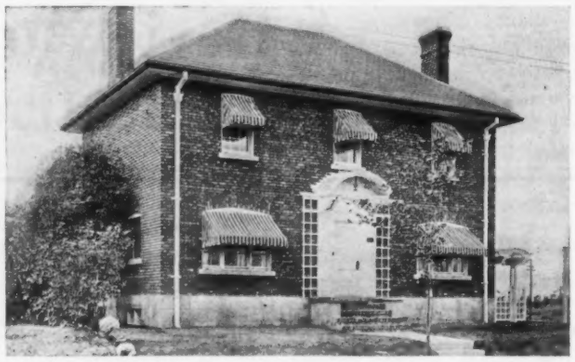
MATERIAL FOR GUIDANCE

It is not the purpose of this article to outline the methods by which a "home-electric" should be organized and operated. A detailed analysis of the experience gained from the three homes conducted in Cleveland in 1921 was published in the ELECTRICAL WORLD for March 11, page 475, with a schedule of recommendations for the guidance of any city. The Society for Electrical Development has also in preparation a handbook on the "home-electric" which will be available soon and covers the subject exhaustively, and on which we have drawn for many of these facts. In planning the activities of the great movement for business development which the convention of the N.E.L.A. will formally launch, however, a picture of the actual experience of the most successful "home-electrics" will perhaps be helpful.

In the first place, there is no "home-electric" demonstration reported so far as unsuccessful. The people have always come. They have always been interested. They have always reacted with a demand for more wiring and more appliances. Results have been directly proportionate to the care and thoroughness with which the project has been planned and executed.

In the majority of the larger cities the enterprise has been sponsored and controlled through either an electric league or club existing in the community or one formed for the purpose. In Denver the general manager was the president of this new league and the local managers of two large manufacturing establishments were vice-presidents. Stock was subscribed to by local electrical interests, including the wiremen's union. The home was designed and built in co-operation with a contractor, some material and services being paid for in stock. In almost all cities a new residence has been used, and in many cases in large towns—Denver, Cleveland and Louisville among them—this residence has been built for the purpose by the league. In many others it has been loaned by the builder. In all but a few cases the house has been sold during the demonstration, and usually at a substantial profit. In virtually every case it has been possible to arrange with a local department store to provide the furniture and draperies,





A Group of Typical "Home-Electrics" from About the Country

FROM Boston to Columbus, Ga., to Utica, to Louisville, to Minneapolis, to Denver, to Sacramento "Home-Electric" demonstrations are meeting with unvarying success. But out of these experiences are developing bits of standard practice which have proven good influences in attracting large crowds and making easier the telling of the story.

though in a few cities the builder has contributed the hangings as a feature of the decoration of the home.

SIZE OF HOUSE USED

The size of the house selected has varied with the community and the neighborhood from a small bungalow to a fourteen-room house, as in Utica. But the usual choice has been an eight-room house, as in Denver, Oakland, Louisville and Cleveland. The value has, of course, had the same range. In Sacramento a house valued at $10,000 was used; in Utica the price was $30,000; in Cleveland three homes valued respectively at $48,000, $37,000 and $17,000 were selected; in Los Angeles two priced at $40,000 and $12,500 respectively, in Toronto one at $13,000, and so on. The number of convenience outlets installed is reported as follows: Toronto, 34; Utica, 42; Louisville, 28; Denver, 50; San Francisco, 37; Oakland, 38; Los Angeles, 28 and 37. The number of appliances in use was: Los Angeles, 35 and 50; Oakland, 40; Sacramento, 25; San Francisco, 31; Denver, 50; Louisville, 49; Utica, 40; Toronto, 34.

The money to finance the enterprise has been apportioned between the co-operating firms according to their size, or to the groups, as in Toronto, where the central-station companies subscribed 50 per cent, the manufacturers and jobbers 30 per cent and the contractors and dealers 20 per cent together. They raised in Toronto a fund of $10,000 to finance four "home-electrics." In Denver they sold for cash $6,750 of stock. In Cleveland they raised more than $50,000 to support a big development campaign of which these "home-electrics" were a feature. Here the percentages collected were: Central stations, 33.22; jobbers, 23.91; manufacturers, 22.44; lighting-fixture dealers, 5.82; industrial and commercial contractors, 5.74; appliance dealers, 3.46. In Utica the total expense was $2,200, in San Francisco $1,400, in Sacramento $550, in Oakland $1,100, in Louisville $2,000, in Cleveland $6,700, $5,000 and $2,900, and in Los Angeles $1,150 and $1,800 for the different homes. This is in addition to advertising space contributed by electrical firms, which was estimated for Utica at $100, for San Francisco at $3,600, for Sacramento at $550, for Oakland at $2,200 and for Los Angeles at $3,600. In other cities large amounts of space have also been devoted to the demonstration by co-operating local interests, and small amounts have been contributed in some cases in labor and material. Newspaper space has ever been the largest element of operating expense, with booklets rating second.

The operation of the "home-electric" demonstrations has almost universally been put in the hands of employees of the co-operating firms, under direction of the home committee. In Utica, in Louisville, in Toronto and in Cleveland, however, special employees were engaged to take partial or entire charge of the home.

HOURS OF EXHIBITION

The homes have been open to visitors daily and Sunday, but there has been a considerable variety in the schedule. In Los Angeles the hours were 2 p.m. to 10 p.m., in Oakland 10 a.m. to 10 p.m., in Sacramento, 1 p.m. to 10 p.m., in San Francisco 10 a.m. to 5 p.m., in Salt Lake 2 p.m. to 9 p.m., in Louisville 11 a.m. to 9 p.m., in Cleveland 1 p.m. to 10 p.m., and in Utica 2 p.m. to 10 p.m. The usual period of the demonstration has been about two weeks, though in Cleveland each home was open for a month. The relation borne by the length of the period to the total attendance is not clear, but the results have been as follows: Utica, 16 days, 15,124 visitors; Columbus, Ohio, 10 days, 6,000 visitors; Cleveland, 32 days with 34,354 visitors, 29 days with 34,790 visitors and 29 days with 13,965 visitors; Montreal, 25 days, 9,000 visitors; Louisville, 14 days, 89,000 visitors; Lexington, Ky., 10 days, 7,000 visitors; Utica, 16 days, 15,124 visitors; San Francisco, 17 days, 20,000 visitors; Sacramento, 16 days, 10,000 visitors; Oakland, 13 days, 30,000 visitors; Los Angeles, 17 days with 19,000 visitors and 25 days with 15,106 visitors. A surprising number of people can be received in such a "home-electric" in one day. In Los Angeles the record day was 6,966, in Oakland 3,537, in Louisville 3,200, in Cleveland, 3,300.

The net cost of entertaining and informing all these people was found to be 10 cents per person in Louisville and 17 cents in Cleveland.

THE WAY OPEN TO ALL

The record is, of course, but fragmentary; yet, incomplete as it is, because detailed statistics are not available from many cities, it serves to point the fact that common experience has found the right way to organize and operate a "home-electric," a way open to all. Many ingenious innovations have been devised in advertising these demonstrations and providing entertainment for the guests. But the basis of it all is the desire on the part of all the people everywhere to learn more about electricity in the home, and the "home-electric" has proved itself a most effective way to demonstrate the comforts of complete electrical household equipment in an interesting and appealing manner, practical and profitable, not alone in the large cities but in towns as small as Boulder, Col., for instance, where, out of a total population of 12,000, more than 2,600 persons visited a unique display in the new residence of the manager of the local central-station company, thrown open for ten days as a "home-electric." The record of Canton, Ohio, is also remarkable, for there 14,000 persons came to see a small demonstration home, being 10 per cent of the population. And in Fort Smith 3,500 people visited the house, which was 12 per cent of the inhabitants.

The Rural Service Opportunity

Initial Problem One of Financing—Fundamental Need for Improving Electric Service to the American Farmer

BY G. C. NEFF
General Superintendent Wisconsin River Power Company, Madison, Wis.

EXCEPT for the difference in the extent of the distribution system necessary to serve the same number of customers, there is little distinction between urban and rural electric service. The electricity supplied in both services is generated in the same way, usually in the same power house, transmitted over the same kind of lines and delivered to similar homes for similar purposes. A mile of urban distribution line may serve from thirty to a hundred customers, while a mile of rural line in many cases will serve only three customers. The new problems introduced by rural serv-

ice are therefore caused either directly or indirectly by the unusually large amount of distribution system necessary for each customer served.

FINANCING PROBLEM FIRST

The first problem is that of financing the large investment necessary to supply rural service. Under present conditions utilities generally require all the money they can get to keep pace with the growth of their urban business, and they are therefore unwilling and often unable to finance rural lines. Furthermore, rural electric service is still in the period of early development, and many utilities are unwilling to invest a large amount of money in what they consider an uncertain business. Most utilities in the Middle West are willing, however, to supply the necessary capacity in the generating station and to supply the increased capacity in the urban distribution or transmission lines necessary to transmit the energy required to some point in the rural district to be served, if the rural customer will provide the money for the rural distribution system. Under this arrangement both the utility and the customer are intensely interested in the successful development of rural service, since both have contributed to the cost of the equipment necessary to supply this service.

Until rural service has become more stabilized and can furnish a proper ratio of return on the money expended, this seems to be the only fair way to handle the necessary financing. Furthermore, if these conditions are properly explained to the rural customers, they are generally willing to contribute the cost of the rural distribution system, especially since this is generally less than the cost of individual farm-lighting sets, which are of limited capacity and for the most part not so satisfactory as central-station service.

THE RATE PROBLEM

The second problem is to determine a proper rate to be charged for rural service. Urban rates have been developed over a period of years, and it can be fairly assumed that they are approximately equitable. They are designed to give the utility a revenue sufficient in amount to cover certain expenses and to yield it a fair return of the money invested. The expenses meant consist of the actual cost of generating the electrical energy, taxes, depreciation and maintenance on the generating plant and distribution system, losses, liability expense and other operating expenses.

There is more or less uniformity in urban distribution systems as regards the number of customers served from a transformer and the number of customers per mile of distribution line. An examination of twenty-five utilities in Wisconsin shows that in normal times the average cost of the distribution system per urban customer is approximately $50. Urban rates are therefore designed to provide, in addition to other things, all fixed and operating costs on $50 of distribution system per customer. It is not uncommon to find rural lines costing as much as $400 per customer. It is evident that if $400 of distribution system must be maintained and operated per customer, urban rates designed to care for only $50 of distribution will not provide an adequate revenue. Urban rates therefore provide wholly inadequate revenue for average rural service.

The rural customer is fair and does not want this service at less than cost, and if the utility management will take the time and trouble to explain fully and carefully the reason for all charges before any lines are built, there will be no trouble in getting consent to adequate rates. If full explanation is not made and the rates are not thoroughly understood by the rural customer, trouble is sure to follow. Explanations must be made in simple language, and such words as distribution system, transformers and depreciation must be clearly explained.

ALL CUSTOMERS PUT ON SAME BASIS

Many rural customers are now receiving electric service at less than cost. This has established a bad precedent which must be overcome. If a large number of new rural customers can be supplied with electric service on a proper basis, the customers now served can be gradually educated to the fact that they should pay more for their service, and in time all rural customers can thus be put on the same basis. It has been found very unwise to make this change too rapidly in the case of old customers, especially before full explanation has been made. The question of discrimination is here raised, but the plan can be justified. There is no reason why the utility should take on additional rural customers at a loss simply because a wrong method was adopted in the past. Neither should the rates to old customers, who in many cases have contributed money to the cost of the lines, be raised until these old customers learn why they should pay more and have had a chance to see that their neighbors are actually paying a higher rate but not an unreasonable one.

One-fourth of the population of the United States live on farms. This large number of people want and are entitled to electric service. The farmer has come to realize that electric service on the farm is a necessity and not a luxury. He can afford it and is willing to pay for it. The farmer's wife is demanding electric light, an electric washer, an electric iron, an electric vacuum cleaner and an electric pump for running water, and she is going to get them all. The farmer's children are no longer content with the old farm home, with its kerosene lights and oil stove, and are asking for the many comforts which electric service has brought to the city home. The farmhands want improved working conditions and know that electric service will lighten their work and make it more pleasant. Everybody on the farm wants electric service!

NEED OF IMMEDIATE ACTION

Are the utility managers going to turn a deaf ear to these demands and compel the farmers to develop their own means of obtaining this service? This would be likely to result in a rural electric system development similar to the development of rural telephone systems, and a menace would be created that no electric light and power company could afford to incur. It is far better for utilities to face the situation frankly and develop a fair and practical plan for supplying rural electric service. The problem should be approached on the basis of pure business and carefully analyzed to bring out all of the factors entering into the situation. There is need of immediate action. Wisely handled, the situation is in the hands of the central-station industry to direct in a manner that will be of benefit to the industry and of infinitely greater benefit to the consumers.

Hydro-Electric Developments Involve an Expenditure of $150,000,000

Construction in Progress Under Licenses Granted by Federal Power Commission Involves Almost 1,750,000 Hp.—Big Creek Project Largest for Which License Has Been Granted

HYDRO-ELECTRIC projects which are now being constructed under licenses issued by the Federal Power Commission involve an expenditure of almost $150,000,000. To April 15 twenty-six licenses had been granted by the commission, of which five cover projects already constructed. The remaining projects, including three which had units completed and in operation when license was issued, are now under actual construction.

The installed hydraulic equipment included in these developments will total one and three-quarter million horsepower if the ultimate development of the Big Creek Project of the Southern California Edison Company and the Kings River Project of the San Joaquin Light & Power Corporation are included. Several of these projects will be developed by stages depending upon the increase in demand for power in the territory served.

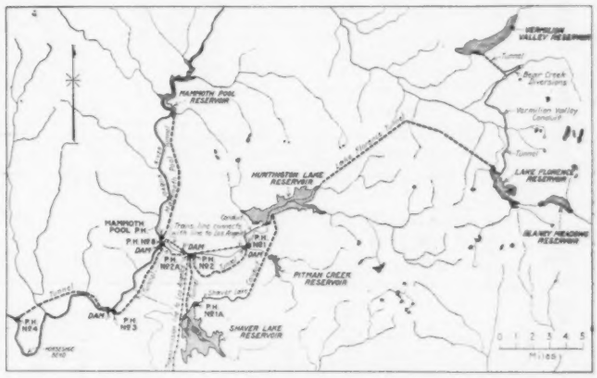
As indicated in the accompanying map, practically every section of the country is represented in these licenses, but California predominates with almost one-third of the total number. The largest of the developments is also in California, namely, the Big Creek project of the Southern California Edison Company, which represents an ultimate development of 545,000 hp. under the license issued by the Federal Power Commission, and of 753,000 hp. if the development is authorized under final permit from the Department of Agriculture.

Detailed data relative to these projects will be found in the accompanying table. Especially interesting are the estimated costs of the various projects as made by the companies themselves or by the engineers of the Federal Power Commission. The total cost of the twenty-five developments is estimated at $149,470,000, of which almost one-half is involved in the Big Creek project of the Southern California Edison Company. The average cost of the projects in the aggregate is $102 per installed horsepower, if the Kings River project of the San Joaquin Light & Power Corporation is not included. However, if the development of the Niagara Falls Power Company is also deducted, the average cost per installed horsepower is $118. The lowest cost is that of the Niagara Falls Power Company, which is estimated at $41 per installed horsepower, and the highest is that of the Home Colony in Wyoming, which is $500 per installed horsepower.

BIG CREEK PROJECT LARGEST DEVELOPMENT

By far the largest new development* for which the Federal Power Commission has granted a license is that of the Big Creek project of the Southern California Edison Company. Under this license the total completed project will involve a hydraulic installation of 545,000 hp., and the total cost of the project is estimated by the Federal Power Commission engineers at $61,152,000. The total electrical equipment is estimated at 407,000 kva., to cost $9,300,000. The estimated cost of the entire project will average $112 per installed horsepower.

The project consists of one earth dam, four concrete dams and two concrete weirs. Almost 129,000 ft. of pressure tunnels will be constructed, three power houses will be constructed or extended, and one three-wire,



THE BIG CREEK DEVELOPMENT OF THE SOUTHERN CALIFORNIA EDISON COMPANY INVOLVES EXTENSIVE SYSTEM OF RESERVOIRS AND TUNNELS

150,000-volt transmission line, 8,119 ft. in length, will connect the system to the main transmission line leading to Los Angeles.

Stations No. 1 and No. 2 have been in operation for about eight years, transmitting power at 150,000 volts to Los Angeles, a distance of 240 miles over a two-circuit transmission line. Station No. 8 was completed in August, 1921. This station was built for 220,000-volt operation, but will be temporarily operated at 150,000 volts pending the construction of additional stations in the Big Creek project.

Following is the construction schedule of the Big Creek project as indicated in the license:

April 1, 1923.
Portion of Shaver Lake conduit from Pitman Creek reservoir to Huntington Lake reservoir.

June 1, 1925.
(a) Florence Lake tunnel.
(b) Portion of tunnel of Shaver Lake conduit extending from Pitman Creek reservoir toward Shaver Lake reservoir.
(c) Big Creek Power House No. 2-A tunnel to full size.
(d) Big Creek Power House No. 2-A to a capacity of 50,000 kw., together with necessary penstocks.

*A license has recently been issued for project No. 175 of the San Joaquin Light & Power Corporation. This completed project will cost $50,970,000. Details will be found in the accompanying table. A license has also been issued for completed project No. 149 of the Wyoming Power Company on Big Horn River, Wyo.

Hydro-Electric Projects Being Constructed Under Licenses Issued by the Federal Power Commission

No. of License	Name of Company	Location	Name of Stream	Dam Data: Type of Construction	Dam Data: Height, Ft.	Dam Data: Length, Ft.	Dam Data: Total Cost	Power House, Total Cost	Hydraulic Equipment: Hp.	Hydraulic Equipment: Total Cost	Electrical Equipment: Kva.	Electrical Equipment: Total Cost	Project as a Whole: Total Cost	Project as a Whole: Cost per Installed Hp.	Reservoir Storage, Acre-Feet	Remarks
13	Henry Ford & Son, Inc.	Dearborn, Mich.	Greene Is., Hudson River					$800,000	8,100	*$680,000			$2,225,000	$275		
16	Niagara Falls Power Co.	Niagara Falls, N. Y.	Niagara River					683,700	210,000	952,500	157,500	$1,324,000	8,700,000	41		Extension to plant No. 3 only.
58	Luther Hill	Independence, Cal.	Sam Mill Creek, Cal.						250				27,000	180		
63	Alaska Endicott Mining and Milling Co.	Juneau, Alaska	Wm. Henry Bay, Alaska						350	47,000			70,000	200		
67	Southern California Edison Co.	Los Angeles, Cal.	Big Creek, Cal.						545,000	2,620,000	407,000	7,740,000	61,152,000	113	307,790	
				Concrete (Dam No. 5)	58	210	$ 104,000									
				Earth	138	4,390	2,000,000									
				Concrete	183	1,005	2,650,000									
				Concrete	128	2,970	2,260,000									
				Multiple-arch, Concrete	180	2,300	4,310,000									
70	Rock Creek Power Co.	Missoula, Mont.	Rock Creek, Mont.						2,000	46,000	1,875	27,000	200,000	100		
77	Snow Mt. Water & Power Co.	San Francisco, Cal.	Eel River, Cal.	Concrete	185	485							2,110,000		215,000	
78	Western States Gas & Elec. Co.	Stockton, Cal.	So. Fork, Am. River, Cal.						6,100							Constructed
82	Alabama Power Company	Birmingham, Ala.	Duncan's Riffle, Coosa River, Ala.	Concrete	95	1,200	1,838,800	1,104,000	110,000	998,000	80,000	1,384,000	11,001,000	100		
94	Alaskan Amer. Paper Corp.	New York City	Orchard Lake, Alaska						5,200		1,200		746,000	144		3,600 hp. in turbines direct-connected to paper machinery.
96	San Joaquin Lt. & Power Corp.	Fresno, Cal.	San Joaquin River, Cal.				750,000	370,000	45,000	400,000	33,750	627,000	5,700,000	127		
104	Home Colony	Cody, Wyo.	Kitty Creek, Wyo.						10	1,300	8	1,800	5,000	500		
108	Wisconsin-Minnesota Light & Power Co.	Grand Rapids, Mich.	Chippewa River, Wis.	Earth, Concrete Core	45	995	282,600						282,600		275,000	Dam only
126	John R. Love and G. A. Von Brecht	Colorado Springs, Col.	Salmon River, Idaho						505				100,000	198		Constructed
130	Grace S. Eyre	Buena Vista, Col.	Chalk Creek, Col.						800	6,000	600	6,000	70,000	88		
148	C. S. Benefiel	Paisley, Ore.							60				9,500	159		
166	McConnelsville Malta Elec. Co.	McConnelsville, Ohio	Muskingum River, Ohio					3,000	500	10,000			34,000	68		Constructed - includes 200 hp. gas engine standby.
175	San Joaquin Light & Power Corp.	Fresno, Cal.	Kings River, Cal.										50,970,000			
	Wishon Dam			Concrete	250	6,475	10,000,000	320,000			6,600				128,323	
	Haas Diversion Dam			Concrete	50	240	200,000	3,220,000			87,500					
	Balch Diversion Dam No. 1			Concrete	70	220	130,000	4,820,000			133,000					
	Balch Diversion Dam No. 2			Concrete	60	330	120,000									
	Bear Diversion Dam			Concrete	20	150	20,000									
	Peart Dam			Concrete	325	1,385	4,700,000	190,000			3,500					
	Farnham Diversion Dam No. 2			Concrete	65	330	140,000	910,000			27,200					
	Farnham Diversion Dam No. 1			Concrete	75	210	170,000									
	Meyer Dam			Concrete	180	1,667	1,440,000	230,000			5,200				21,000	
	Kings River Diversion Dam			Concrete	85	550	400,000	660,000			21,600					
184	El Dorado Power Co.	San Francisco, Cal.	South Fork American River, Cal.	Intake Reservoirs—masonry	55	385	884,000	191,000	21,500	175,000	15,000	530,000	4,750,000	220	16,000	Initial development only
				Two Twin Lakes dams—earth	85 / 70	1,250 / 535										
185	Southern Sierras Power Co.	San Francisco, Cal.	Vivian High and Willow Creeks, Cal.						3,350	27,000	3,000	83,000	630,000	188		
206	George Inlet Packing Co.	Portland, Ore.	Beaver Falls Creek, Alaska						90							Constructed
213	J. H. Cann	Juneau, Alaska	Cann Creek, Alaska						75							
236	Blue Mountain Irrigation Co.	Monticello, Utah	Pole Canyon, Utah						36							
241	Freshwater Bay Lumber Co.	Douglas, Alaska	Parloff Harbor, Alaska						100							
253	Henry Weber	Buena Vista, Col.	Denny Creek, Col.						100							

* Includes hydraulic and electrical equipment.

June 1, 1927.
(a) Vermilion Valley conduit with temporary diversion works across Mono and Bear Creeks.
(b) Remaining portion of Shaver Lake conduit.
(c) Big Creek Power House No. 1-A to a capacity of 50,000 kw., together with necessary penstocks.
January 1, 1928.
(a) Florence Lake reservoir.
January 1, 1930.
(a) Vermilion Valley reservoir.
(b) Rest of Bear Creek diversion works.
(c) Blaney Meadows reservoir.
(d) Shaver Lake reservoir.
(e) Rest of Big Creek Power House No. 1-A, together with necessary conduits.
(f) Rest of Big Creek Power House No. 2-A, together with necessary conduits.
(g) Rest of Big Creek Power House No. 8, together with necessary penstocks.

NIAGARA FALLS DEVELOPMENT WILL ADD 213,130 HP.

The second largest new development for which a license has been granted by the Federal Power Commission is that of the Niagara Falls Power Company. In addition to the existing installed capacity of 383,600 hp., of which 115,500 hp. will be used as a reserve after the ultimate development is completed, the license provided for new construction with a hydraulic installation of 187,500 hp., consisting of five 37,500-hp. turbines to be added to Station No. 3 and 3,130 hp. to be added to Station No. 2. A new design has since been submitted for the new construction substituting three 70,000-hp. turbines for the five smaller units, or a total new development of 213,130 hp. This added development of 22,500 hp. is obtained at an increased cost of only about $80,000. The total cost of the river improvement at the inlet to the tunnel, the tunnel, forebay and penstocks and extension to Station No. 3 is estimated at $8,700,000 (exclusive of the transmission line and substation equipment), of which $683,700, or 7.9 per cent, is for powerhouse construction; $952,500, or 10.9 per cent, is for hydraulic equipment, and $1,324,000, or 15.2 per cent, is for electrical equipment. The generator installation will be rated at 195,000 kva.

On account of the total absence of dam construction and the comparatively small amount of canal and tunnel construction necessary, the cost of the project per installed horsepower will be only about $41, which is probably the lowest unit figure ever recorded for a large hydro-electric development. A transmission line has been constructed leading to the Echota substation and to Buffalo. The latter is known as the Grand Island Transmission Line and consists of a land section of 8 miles with two three-phase circuits and a river section of 1 mile having four circuits. This will cost $392,000.

DEVELOPMENT AT MITCHELL DAM, COOSA RIVER

Third in the list of projects now under construction is the Coosa River development of the Alabama Power Company at Duncan's Riffle, designated as the Mitchell Dam Project. The project consists of a dam, a power house and a transmission line connecting this plant with the existing primary transmission system of the Alabama Power Company. The dam will be constructed of concrete and will have a height of 95 ft. and a length of 1,200 ft. The cost of this portion of the project will be $1,838,800. The power house is to be an integral part of the dam, having provision for an ultimate installation of five units. The initial installation will be two units, each having a capacity of 22,000 hp. This hydraulic equipment will be installed under a patented scheme whereby several feet of additional head is gained because of the effect of the tailwater.

The initial cost of the hydraulic installation of 44,000 hp. is estimated at $399,000, and the completed hydraulic equipment of 110,000 hp. will cost about $998,000. The initial electrical equipment of 32,000 kva. will cost $553,600, and the ultimate electrical equipment of 80,000 kva. will cost about $1,384,000. The transmission line will have a length of 12.2 miles, extending to the company's present plant at Lock No. 12 on the Coosa River, and will cost $250,000.

The estimated cost of the ultimate project is $11,001,000, or $100 per installed horsepower. Actual construction of the dam was begun on Aug. 8, 1921.

EL DORADO POWER COMPANY PROJECT ON AMERICAN RIVER

The project of the El Dorado Power Company on the south fork and headwaters of the American River in California involves a hydro-electric power plant of

WIDE DISTRIBUTION OF HYDRO-ELECTRIC PROJECTS BEING CONSTRUCTED UNDER LICENSES FROM FEDERAL POWER COMMISSION

107,500 hp. ultimate installed capacity. The initial development will consist of two 10,750-hp. impulse waterwheels, operating under a net head of 1,750 ft. The cost of these turbines installed is estimated at $175,000. Later installations will consist of four 21,500-hp. units of similar type, making a total of 107,500 hp. Each wheel in the initial installation will be directly connected to a 6,600-volt, three-phase, 60-cycle generator rated at 7,500 kva., and for the larger units 15,000-kva. generators will be used, making the ultimate rating of the electrical equipment 75,000 kva.

The project includes five storage reservoirs on the headwaters of the American River, a diversion dam, and a diversion canal about 25 miles in length. The cost of an initial storage of 16,000 acre-feet is estimated at $576,000, the cost of the power house at $191,000, and the hydraulic and electrical installation of 15,000 kva. at $530,000. A steel-tower, double-circuit transmission line, designed for 120,000 volts but to be initially operated at 60,000 volts, approximately 6 miles long, will connect the power house with the primary transmission system of the Western States Gas & Electric Company at Camino.

The cost of the initial project is estimated at $4,750,000, or $220 per installed horsepower. The unit cost of the ultimate installation will, of course, be much less by reason of the total cost of the diversion works and power house being included under the cost of the initial project.

Maintaining Joint-Pole Lines on "Fifty-fifty" Basis

Second and Succeeding Occupants Pay Flat Rate per Pole and Share Maintenance Expense—Joint Pole Yard of Questionable Value

By Fred H. Smith
Assistant General Manager Worcester (Mass.) Electric Light Company

MANY advantages accrue to public utilities and to the municipalities which they serve through the use of joint pole lines in districts supplied from overhead circuits. Reduced investment, lower maintenance outlay and decreased obstruction to the use of thoroughfares are worth a good deal of money to all concerned; but these depend largely upon satisfactory intercompany relations for successful attainment and maintenance. Simple agreements, fair to the two or more companies

AN EXAMPLE OF JOINT POLE USAGE IN MASSACHUSETTS

involved in every joint pole line, are the foundation of good relations and efficient co-operation.

The question has been asked: "Upon what basis should a central-station 'trade' with a telephone company or other utility for a reciprocal pole interest?" The answer, in my opinion, is that each company shall agree upon a flat-rate cost and to the maintenance of joint poles in proportion to the number of companies using such lines. That is, where two companies use a common pole the second occupant may fairly pay a flat rate per pole if the pole is jointly occupied within a stated period after its erection. Furthermore, over the total area served two companies, such as a central-station and a telephone organization, may fairly divide on a "fifty-fifty" basis the work or the expense of joint pole maintenance, including guying.

An arrangement based on the above scheme has the great advantage of simplicity as compared with the practice of charging for pole occupancy on the basis of the number of "hitches" made. Developments in safety engineering during the last decade or two have established well-defined locations for wires of different voltages and service usefulness. The work of the committee on overhead-lines construction of the National Electric Light Association has been most helpful in this field. The tendency, at all events, is for the assignment of services to become standardized in any particular company and probably over wide areas of the country. This means that a simple agreement involving no complex valuations or computations can generally be arranged in a given community if the utilities concerned are desirous of going ahead on a fair give-and-take basis.

Application for pole rights on the public streets or alleys is generally made to the municipality by the utility first expecting to enter a given district. If it is known at the time when a telephone company applies for pole location rights that the local central-station company will very soon wish to occupy space on the pole or poles a joint application may be framed to save inconvenience. In some cases the telephone company may, by agreement, file all the applications required by the municipal government for joint-pole locations in the public streets or alleys. This may be a great convenience to the telephone company by permitting it to use standardized forms and data sheets over an area perhaps many times greater than that served by a single central station, involving a multiplicity of circuits and a well-settled procedure. Duplication of effort by the central-station company is correspondingly diminished.

Companies Must Keep in Touch

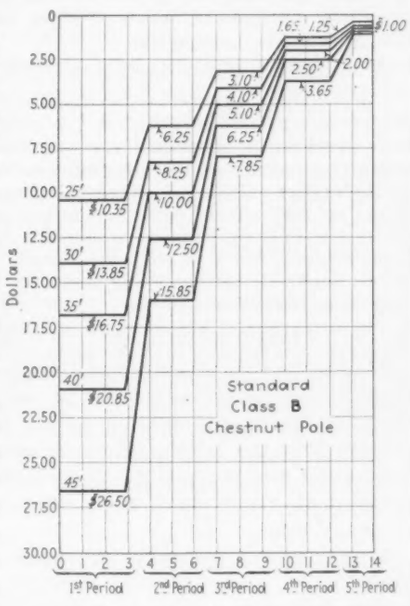
In cities and towns where so-called back-yard services are used each utility will naturally erect its own poles as needed, but two or more companies maintaining good co-operation will keep sufficiently in touch to plan for joint use as far ahead as possible. Permits from property owners and not from the municipality are required here. A second company making use of a back-yard pole line under joint-use agreement will pay on the basis of a pole value upon an agreed basis, which, as I have indicated, seems to work out well if fixed in proportion to the number of utilities concerned.

By agreement a central station may maintain all poles on public thoroughfares for joint use and bill the other utility occupants for pole cost in place in proportion to the number of companies sharing the use. This is a logical arrangement in view of the street-lighting construction frequently required; but, of course, an agreement whereby the telephone company would maintain all joint street poles and bill the central-station company its proportional cost might be preferred in some towns. The vital point is to get a fair sharing in costs. Each utility will properly limit itself to doing construction work only upon its own lines except in emergencies, and under this plan its standards of construction may be easily and economically maintained.

It is helpful to establish and maintain an agreement as to the value of poles and different periods during their life, so that one company becoming an occupant of a pole sometimes after erection may be required to pay only its fair share of the worth of the pole from then on. In the accompanying diagram a set of pole-value curves based on a life of fourteen years is shown. According to these curves, for example, a chestnut pole 30 ft. (9 m.) long is valued at $13.85, and this value is assumed to hold for the first three years of its life. If one company

should install a run of poles on its own account and afterward, up to three years, if a second company should seek joint occupancy, the second company, on the "fifty-fifty" basis, would then pay the first one $6.93, or one-half of $13.85 as its share of the current value per pole. If, however, the second company should enter into joint occupancy from four to six years after pole erection, the value of the pole would have decreased to $10 for the second period, and only $5 per pole would be paid for the privilege of joint ownership. Thus, by three-year periods, the value of the poles declines, until by agreement all poles attain a nominal value of $1 at the end of their service life of fourteen years. Diagrams of this kind, which may easily be put in tabular form if desired, are convenient among companies wishing to take account of pole depreciation in joint-use agreements.

The desirability of a common pole yard for utilities in the same territory is open to question, in view of the space requirements, haulage costs and differences in storehouse and yard locations among companies. It seems best for each company to maintain its own yards, particularly in view of the substantial number of separate poles required for individual company service and the great area, relatively speaking, covered in many cases by a telephone company as compared with a central station. Unless a really vast number of poles is handled annually, a joint pole-treating plant also appears in most cases too expensive to be warranted. An agreement on standard methods of pole treating, however, is most desirable between companies using poles jointly.



SAMPLE CHART OF POLE VALUES

A point which sometimes causes trouble in intercompany relations is that of service attachment locations from joint-pole lines. In general, a central-station service to a building is carried above the telephone lead, following the widely accepted plan of running telephone wires below central-station primary and secondary wires on pole lines. A little care in maintaining these relative heights in making building attachments will save expense later, and this should be borne in mind by each company, regardless of which makes the first entrance. In some places the telephone company tries to enter the south side of a building to insure maximum dryness, while the central station enters on the north side. Knowledge of local practice between companies, combined with co-operation between line superintendents and foremen, goes a long way toward maintaining smooth relations and keeping costs down where they belong.

Joint-pole maintenance may be conveniently handled in more than one way, but the plan used at Worcester is simple and effective. Here we have arbitrarily divided the city into two substantially equal geographical parts, and, generally speaking, the telephone company maintains all joint poles on private property in one of these districts and the central-station company maintains those of the other district. All joint poles on public thoroughfares, no matter in which district, are maintained by the central station, half the cost being paid by each company. Each company does all its own work, with minor exceptions, upon the overhead circuits belonging to it. It is desirable that the line forces of each company be active in pole maintenance, and this arrangement has given good satisfaction and, we believe, has brought since its adoption a fair distribution of the expense of joint pole maintenance among the companies. A certain independence of operation is very desirable in the handling of line maintenance forces among different utilities, and if these are well-proportioned to normal requirements, when emergencies arise one can be used to supplement the other with great advantage to the utilities and the public.

In case of joint-pole relocations a prorating of expense among companies may be convenient on the basis of their mutual interest in the change, and in case of exceptionally heavy pole construction, guying, etc., due to unusual requirements of one company (such as installing a run of 13,200-volt three-conductor cable), a settlement of cost on the basis of a separate adjustment through conference seems fair. Too much emphasis cannot be laid upon friendly co-operation between line-maintenance executives and subordinates as a final factor in the success of joint-pole-line agreements.

Maintaining Marketability on Customer-Owned Securities

A Few Statements of Individual Experience and Opinion from a Number of Central-Station Executives

"THE SECRET, the very fundamental, of success in selling central-station junior securities to the company's customers lies in the maintaining of the market, and the maintaining of the market is the simplest and easiest detail of a stock campaign. For a utility stock certificate is just like a banknote. A banknote is valueless in itself, but the fact that the Federal Reserve bank or Uncle Sam has printed on the face of it the pledge that he 'will pay to the bearer on demand' makes it good money. And a similar pledge by the utility that it will buy back the stock certificate or will sell it to some one else at any time the owner wishes to dispose of it makes the stock good money in the same way. That is about all there is to it."

NEED ONLY LET THEM KNOW

This statement by a central-station executive who has been particularly active and successful in the development of customer ownership is typical of the experience of many companies which have recognized the importance of maintaining marketability. For another company says:

We have never had occasion to maintain a market for our securities. Our newspaper advertisements have made no reference to marketability, and we have not been asked so

far to buy any stock back for our customers. But, in case a purchaser asks a salesman what he shall do if he later wants to sell his stock, the salesman tells him that the company at any time will be glad to assist him in finding a purchaser. This is all the purchasers want to know.

It does not seem to make much difference to the customers whether the company has formally established a resale department or not, so long as they know that there will be a way to sell. In one city in New York State the company does not maintain a resale department. And it "does not buy back stock for the customer, but it does make a strong effort to resell and has done so in several cases." In a neighboring city, however, though the company's advertising carries no reference to reselling shares, it says:

The salesmen are instructed to advise the customers, in case the point is raised, that we maintain a permanent investment department and will resell their shares for them in case they wish to dispose of them, or if cash is needed immediately, we arrange with them at a bank so that a loan can be made with the shares as collateral, and before the note is due we shall have sold these shares. We have placed

THIS MAP SHOWS STOCKHOLDERS OF THE COMMONWEALTH EDISON COMPANY

This huge map in a window of the Commonwealth Edison Company's Electric Shop in Chicago marks with large black pins the density and location of the local stockholders. Little red lights mark the position of the eight generating stations and green lights indicate the sixty substations. One of the interesting features is the fact that the greatest number of stockholders per square mile is shown to be in the "North Shore" residential district. There are 24,000 stockholders in Chicago with a very general distribution. This map will be on exhibition at the N.E.L.A. convention in Atlantic City next week.

approximately 5,500 shares with a few more than 600 customers in a period of approximately five months. We have had no shares turned in for resale and only a few time payments have not been kept up.

This from another manager:

Every man who has no money in the bank wishes that he could save. Every man with a bank account has some money which he can invest. Therefore practically every household is a "prospect" for the sale of utility stocks on the installment basis, provided that a way is made for the purchaser to sell should he need to. The more frankly and freely this resale protection is represented to the customer the easier is his mind and the more willingly he buys.

Reasoning similarly, a Pennsylvania company says:

We maintain an investment department where customers do all their trading. We buy back from them any stock they have subscribed for on partial payments by returning to them all they have paid plus 6 per cent interest. However, there is little trading of this kind, as the customer is reluctant to dispose of his subscription owing to the fact that the market on our securities has advanced from the selling price of $42 per share to $50 per share. It has not been necessary to advertise that we conduct an investment department. Our customers all understand that they can trade at our office.

The attitude of the local banks, of course, has a direct influence on marketability. An Ohio company makes this statement out of its experience on this point:

The banks generally seem to be "sort of on the fence" when it comes to our stock. We have heard in one or two cases that they recommend it, and we know of a number of cases where they have directly opposed its purchase. We feel that as a rule they sort of damn it with faint praise, saying it is probably all right, but there are other things better. We believe that most of the banks are convinced that the company and the stock are sound. In one case, however, a bank bought some traction bonds eighteen or nineteen years ago on which later on default was made. The bank has since been bitterly opposed to public utilities of any kind. One of the leading banks caused us quite a bit of trouble until we told it we were maintaining a permanent securities department, when it right-about-faced, and we believe it is now helping us.

Another Pennsylvania central-station company says:

The various bankers in the four counties in which we operate accept our securities as collateral and recommend their purchase to customers who inquire, but have not sold any of our securities except where an occasional customer of theirs has called and asked them to purchase for him. When we first offered securities to our customers we heard indirectly of two bankers who were not enthusiastic in recommending them to their customers. The balance sheet of our financial statement was presented to the bankers, and they were readily convinced.

INEXPERIENCE OF THE PURCHASER

It must be remembered that the average purchaser of these shares is inexperienced in security holding and therefore needs and obtains advice, and it is most important that the advice which he receives be based on knowledge and sympathy. Of this the manager of the investment department of another light and power company says:

We find that 95 per cent of our customers do not have any knowledge whatever of stock exchange trading. This is evidenced by the number of stockholders who call at the investment department explaining that through adversity they are compelled to sell. Naturally they come to the place where they bought and inquire if they can sell their holdings for what they paid for them. If we do not have a buyer and the customer wants his money, we give him a check on sight at the market price, and he goes out happy. He is sure to spread this news among his friends, and thereby the company benefits in good will and favorable advertising for another issue.

We consider our investment department as a very necessary adjunct to our business. We have approximately 2,100 shareholders in our territory, all of whom depend more or less on our company for advice.

"In a word," says another executive in appropriate conclusion, "the man who under this plan buys the securities of a central-station company is not only the purchaser of stock; he is an old acquaintance, a friend, an established customer, and he must be treated as such. He loans the company his money because he believes in the company as well as because he wants a good investment. And if anything happens which makes it necessary for him to get that money back, it must be made easily possible, for this old friend must be taken care of cheerfully and without delay."

Some Economic Engineering Problems to Think About

By LOUIS R. LEE
Chief Engineer E. W. Clark & Company Management Corporation, Columbus, Ohio

Location of Plants, Lines, Substations as They Are Affected by Market, Labor, Fuel, Water and Transportation—Feasibility of Future Changes and Extensions — Efficient Use of Equipment and Arrangement Thereof

THE development of every electric service company, virtually without exception, has been a compromise—a compromise between what is desired and what the circumstances permit. When emergencies and possibilities arise it is the duty of the engineer to present to his executives all of the reasonable and feasible alternatives. He should be able to weigh good engineering in with what some may think concerns only expediency and should present the true measure of the value of the different alternatives. If the engineer finds that by building a permanent dam and installing good equipment, but minimizing the cost of the superstructure and other features of what would be styled a well-rounded development, he can reduce his cost so that the development may be started in time, he is exemplifying good economics.

There is little chance for the engineer to be criticised if he installs a minimum of good equipment, incorporating in his plans such ideas as will permit of extensions or additions or further elaboration as time goes on, but getting for his initial investment a maximum of reliable capacity. If, in contrast with this plan, he builds an elaborate plant complete to the last detail, getting a unit cost possibly not extremely high, but spending considerably more money in all than he might have spent by a more simple plan, his economics are out of balance.

The engineer should have a trained idea of the general fitness of things. It is certainly well to consider the general appearance of the buildings and their appurtenances when plants are to be built in thickly settled districts; but of what advantage is ornamental appearance to a building situated miles from the thickly settled districts or where probably it never will be surrounded by any built-up district? There is, of course, little excuse for flimsy buildings that will involve high maintenance cost. It is usually a fact that substantial, plain buildings of the very simplest nature can be built for rather low figures. Moreover, the advantage lies not so much in the saving in these buildings themselves as in the idea which goes along with simple construction, for it is generally true that plans calling for tiled walls and mosaic floors conduce to the same trend toward expense in the more essential features.

In presenting his alternatives the engineer must be sure that he does not offer schemes which if followed will lead to trouble due to inadequate plans. On the other hand, he may properly present alternatives which limit the things they make possible so long as these limitations are carefully enumerated at the outset. Every plan must have in it some features to take care of future needs. These features of most plans have cost a great deal and probably in most cases have been worthwhile investments, but a great many exceptional instances have shown that too much consideration can be given to the future. Usually provisions for future consideration are rather cheap as they may obviate making investments which would be poor ones and may point to other possibilities which can be realized on. However, it is well to weigh carefully and point out to those who authorize the expenditures just what things are being put in and paid for with the sole idea that some time later they may be required. It sometimes is true that with an eye to the future a feature here and there can be provided along with the initial work at a very slight cost, considering that the labor involved is about the same in either case and the material required only slightly more. However, this argument can easily be overworked and may sometimes even hamper the plan for the things that are to be done right away. One of the great dangers in making the provisions for future possibilities is that, because of the changes in the design of equipment from year to year, there is no certainty at all that five or ten years from now, or even next year, the engineer will want to install additional equipment like that he is installing today. Therefore, in making his plans about the best he can do is to leave space and to show in his drawings what equipment similar to that of today may be required in the way of extensions to the present plant.

ULTIMATE COST MUST BE CONSIDERED

In branching out to new territory a company must always consider not only the initial unit cost of extensions to its plant or buildings, but also the ultimate cost. Usually, present plants, if designed and laid out with some foresight, can be added to at a relatively small cost, so that the unit cost of the extension should be rather low. Moreover, where a number of water-power developments are being built upon a stream, especially if there is any storage in the development, it is of great advantage to build one plant after another up the same stream, because water stored in the plants furthest up the stream will be used over and over by the plants further down. It is also usually found that the cost of transmission lines serving a number of plants in this way is rather low. However, there is advantage in having water power on different streams in widely separated territory because difference in weather conditions may prevent a prevalence of low water or flood water in one section from being experienced in another.

In hydro-electric enterprises it is necessary to consider what the stream may produce in power if developed to a maximum; that is, if all the natural fall is used to best advantage. A stream may present several sites

some of which can be developed more cheaply than others. There may also be alternatives as to the number of sites that may be developed while still utilizing the total fall of the stream. However, such a plan might cause the unit cost of the developments to be excessive and render the proposal commercially unattractive. Is it not better to develop the stream so that it will be a good business proposition even though something less than 100 per cent of the fall is developed? A similar consideration enhanced in degree is forced by the impracticability of developing any part of some streams because of their wide range in stream flow. While it may seem the right economic course to develop as much water power as possible in order to conserve coal, yet investors are certainly not ready to spend money for its development unless the expenditure promises to be a good business venture.

From the point of view of conservation steam plants should burn the lowest grade of coal, yet that is often quite impracticable from a business standpoint. In the same fashion, the company seeking steam power has some choice as to the cost of the plant it may build. The cost will increase with higher efficiency. There is a point where the higher efficiency will not make a proper return on the additional investment required to obtain it. Therefore the company having mixed water and steam power has an even greater problem in determining, first, the general characteristics of steam generation. The first essential of the standby steam plant, of course, is reliability. But a plant may be built to be more or less efficient without changing its reliability. Here again the most valuable plan for the steam plant will be one which will allow it to be started with moderate efficiency with provisions for additions which will increase the efficiency. A flexible plan of this kind is extremely valuable as it allows the company to try out its ideas by experience, and when it finds that new expenditure will be justified by additional efficiency it can secure this efficiency when it is most needed.

BEST WAY NOT ALWAYS MOST COSTLY

The best way to do a thing is not necessarily the most expensive way, neither is it the way that costs least, but it may approach one or the other extreme according to a combination of many factors.

The location of standby steam plants must also be made with reference to load centers and existing or prospective water-power sites, but it also must be affected by the freight rate on coal and the availability of cheap fuel, the cost of the coal being determined by the kilowatt-hours that will be produced by each dollar expended in its purchase.

In the consideration of transmission lines for new territory there are many factors. Some of this territory may require long, high-voltage lines, while in other parts only extensions to lower-voltage lines may be necessitated. It is usually rather easy to go into a new territory and get some load immediately, but it is much harder to close contracts for a large percentage of the available load on existing lines. There are always some small plants that have use for exhaust steam or that have a quantity of waste product which may be used as fuel. Such considerations make the generation of power somewhat of a by-product. There are, therefore, sometimes good reasons why an individual plant must, from an economic standpoint, continue to exist rather than be superseded because of the purchase of power from central stations, although eventually, as these plants wear out and as their by-product becomes relatively a smaller item in their total expense, they will be glad to transfer the burden of power generation to some one else and devote their entire energies to their main manufactured product.

The characteristics of prospective loads should always be known because a power company always has before it the opportunity of improving its load factor by diversity of demand or by actually high load-factor use. Night load is very hard to get, and certainly extra effort would be in order if thereby a large block of night load or twenty-four-hour load could be secured. The engineer should have pretty definite knowledge concerning load factor, power factor, load balance and momentary and sustained peaks. He should also know what damage the customer will suffer if service is interrupted momentarily or for various extended periods. It will be much more satisfactory to discuss probable interruptions than to review actual outages. If the engineer lays claim to any anatomical possession more important than a wishbone, he must feel reponsible for reliable service. Such service cannot be given with inadequate facilities, and adequate facilities cannot result from plans sketched out on the back of an old letter.

CUSTOMER FINANCING AN IMPETUS TO LOAD

Sometimes it is practicable for the prospective new customer or customers to supply the necessary capital or even to build the line extension. Such a method usually serves as an impetus to the community to obtain as much load for the power company as possible because it reduces the proportional capital charge to each indvidual customer. In many cases this is a very good way for the power company to secure a large percentage of the available load. However, in building any line extension it is necessary for the power company to consider continuity of service, and therefore a substantial line must be built. In addition to continuity of service the maintenance of the line must be considered. This brings up the question of the type of line—whether steel towers, black or galvanized iron, wood poles, plain poles or treated poles, and so on. Any of these materials can be used to build a good and substantial line, but if the line is to be an especially heavy one traversing a right-of-way which is rather hard to get at, in a rough country where the spans may be very long, it may be found that the best steel tower is the cheapest structure. If, on the other hand, the line is to run along or near a public highway, where it can be reached quickly and easily and where the spans may be of any reasonable length, then possibly the treated wood pole will, besides being low in first cost, permit of maintainance at a reasonable charge. The insulator item may be an important one, especially for the higher voltages.

In building transmission lines the larger conductor can be strung at virtually the same cost as the smaller one. If at the time of building conductors are low in cost, the larger conductor may be a good investment. However, there will probably be many things that will determine its advisability. The demand for the transmission of electrical energy over a given line may decrease in the years to come. Many other factors may influence the importance or the need of a certain transmission line. Although it is true that a considerable percentage of the cost of transmission lines is invested in movable property, yet it would not be generally considered a good plan to build lines with the idea that they are going to be taken down and moved from one point

to another. As things go, they are about as permanent an investment as the power company is likely to have.

Costs may be greatly increased by providing too much for emergencies. It would be hard to determine the amount of expense which is involved in plans for special cases. For example, practically all power transformers are purchased with, at least, taps for various voltages, while many transformers are purchased with various winding combinations. If all power transformers were to be provided with taps and combination windings, there would eventually be provided a certain amount of transformer capacity which would never be used. It has been found, however, that in the development stage of light and power companies a great deal of flexibility in equipment is a real advantage, because such companies usually are forced to develop rapidly and are required to meet numerous emergencies and serve new customers on short notice. Flexibility of equipment and many possibilities of transformer arrangement made possible by means of taps and winding connections help the operating force to meet these emergencies satisfactorily. The engineer must study this phase of the question and see, as the development of the company proceeds, what provisions might have been made to better advantage and what the general trend of the company's progress is. It has been found in some cases advantageous for companies to spend large amounts to simplify generating and transmission characteristics. Systems have been built up of a number of smaller companies, thus bringing together different voltages, frequencies and phase characteristics which have complicated the whole scheme of things. Movements like the superpower surveys will help a great deal in bringing the country together on reasonable voltage and frequency standards.

It is really a question of economics whether old equipment should be remodeled and brought up to date. There are many who believe in using a piece of equipment as the manufacturer designed and made it, and then when it ceases to be entirely adequate to junk it and start anew. Quite often, perhaps even in the majority of cases, that is the safest course to follow. However, much profit may sometimes be reaped by bringing equipment up to date, and surely the engineer is remiss in his duty if he does not investigate all such possibilities.

Local Interdependence of All Electrical Men

Central-Station Companies Must Co-operate with the Local Electrical Trade in the Rendition of Service to the Community

By William H. Atkins
General Superintendent Edison Electric Illuminating Company of Boston

IN ONE very important particular at least all of the branches of the electrical industry share a common aim—that of rendering service to the public. Unless the manufacturer, the jobber, the contractor-dealer and the central-station company function as public necessities in the scheme of civilized life, they must pass from the world of affairs. It is easy for one or another branch of our industry to become so absorbed in its own immediate problems that those of other branches are overlooked, along with the relations of each branch to that final source of revenue, the ultimate consumer. If we stop and think of these things, we soon realize that the industry is highly interdependent and that successful development cannot be had by disregarding the interests of any other branch of the electrical industry.

I am very glad as a central-station executive to testify in these columns to my conviction that unity of purpose is nearer realization today in the relations of the central-station company and the local electrical trade than ever before. There have been many discouraging experiences in our industry among those who have tried to bring mutual understanding to bear upon trade development. Each branch of the industry has had its troubles and then some. The failure to get the other fellow's point of view has handicapped progress, and lack of initiative, poor business methods and lukewarm confidence have held back development at times when every shoulder ought to have been at the wheel. To deny that discouraging experiences still arise would be outside the truth, but today a better degree of co-operation is evident among all who are willing to play the game fairly and squarely, recognizing one another's viewpoints and putting into practice joint efforts to develop electrical service in every field.

Prosperity Is Mutual

It ought to be clear that in the long run the prosperity of one branch of the industry spells profits to the others. Some people still appear to think that the central station regards itself as sufficient unto its needs, indifferent to the success of the wiring and appliance retailer. Capital is concentrated into one organization in the central station while it is distributed among competing retailers. This means that uniformity of policies and practices is easier for the central station to attain, but it does not mean that the central station can get along well without the co-operation of the local trade.

For many years the Boston Edison company has been developing its system to the mutual profit of the local electrical trade and itself. We have maintained a vigorous sales organization and have placed our credit at the disposal of house-wiring concerns that have done installation work and have secured new business by this means all over our territory. We have sold electrical appliances in competition with the local trade and are still selling them. We believe in selling at list, but that does not in our opinion preclude our moving shopworn or obsolete stock at reduced prices, and we see no injustice in the special sales we have conducted, usually after full advance notification of the local trade.

Our fundamental reason for existence is to supply electrical energy, and we have already begun to lean more and more upon the local trade interests where those interests have shown themselves prepared and willing to merchandise electrical conveniences as they should be marketed.

The central-station company might abandon itself to supplying existing customers and to meeting the needs of those automatically coming upon the system or solicited by company employees, but if it did this, it would fail to render its full service to the community. We cannot accurately tell just the amount of new business that comes to us year by year as the result of "missionary work" by contractor-dealers, but unquestionably these men are constructively helping the central station to attain larger usefulness. The more pro-

gressive wiring contractors and dealers—those who co-operate most willingly with us and who have the vision to see that every new installation well made helps the entire industry to prosper—are in a sense partners in our work and true sharers in its rewards. It is not a matter of size, for we recognize that the very small contractor who does a good job adds desirable outlets to our system, and he receives the same fair treatment from the central station that is accorded his larger competitor. We do no inside wiring, and it is a satisfaction to see the increasing mutual confidence apparent, even if there is still room for improvement.

The Boston Edison company serves over 600 square miles of metropolitan and suburban territory and about twoscore cities and towns. To insure a constantly better understanding between ourselves and the local trade, we assigned about a year ago to this contract work an assistant to the general superintendent, who devotes his entire time to questions of inter-trade relations. Thus we are endeavoring to give a personal touch to the company's attitude toward the local trade and are trying, successfully I believe, to build up a warmer friendship among electrical men concerned with the extension of electrical service into all these communities. What cannot be accomplished if the spirit of inter-trade co-operation continues to develop, as I believe it must, in the coming years of our industry?

Open the Central-Station Doors Wider to New Business

The Time for Extreme Conservatism Is Past—The Public Demands Extensions of Electric Service and This Demand Must Be Met

BY WILLIAM GOULD
Commercial Manager Massachusetts Lighting Companies, Boston, Mass.

IT IS time for the central-station company which has not reached the point of voluntarily suspended growth, not to say coma, to adopt a bigger and broader commercial policy than is evident in altogether too many companies. There was some reason for putting strict limitations on development during the war, when the demand for money and materials was imperative to the winning of the conflict. I am afraid that some managers are still holding back expansion through inability to realize that war-time restrictions long since disappeared in the background of central-station history, and that the public is waking up very rapidly to a perception of what sort of electric service it is entitled to and must demand.

The question has been raised of how the market for central-station service should be analyzed by the commercial departments of such organizations. Frankly, I see little reason for extended analyses of this kind by those whose business it is to market electrical conveniences and to increase the demand for electric service. To put the case in a nutshell, I believe that it is time the central-station industry threw open its doors for business on existing lines, without spending so much time and effort in proving that new business should be taken on circumspectly and in the fear of its effect on existing plant and line capacities.

The people in almost every section of this developing country are thoroughly aroused to the necessities, comforts and conveniences of electric service. In our electric properties (eleven in number) on the Massachusetts Lighting Companies group the number of electric meters in service has risen from 7,110 in 1914 to 20,459 in 1922. We are trying to make it easy, not hard, for the public to obtain our service, and the rate of increase is now so rapid that it is absolutely clear that the public intends to have the service which it wants and which we are doing our best to furnish.

OPPORTUNITY TO TAKE ON DIVERSIFIED BUSINESS

Our companies, like many others of moderate or smaller size, purchase energy at wholesale rates and distribute it over local areas. Only one of our own properties operates its own generating plant. For some time to come there should be little question of such companies' concentrating on this or that type of load. If spare capacity in lines is available, let us make every effort to cram these lines with service, welcoming business of all sorts and going to work to provide additional facilities as the growth of business dictates.

This is no time to adopt a "pussyfooting" policy regarding new business. The public will have service in the long run, and if we do not provide it, who will? Shall we leave matters to develop through agitation until municipal plants are established? I take it that the vote is unanimously in the negative. But, you may say, would it not be well to concentrate on securing off-peak business or long-hour loads, rather than try to encourage additional consumption of energy from virtually all sources? Again the answer seems to me clear. Let us take on loads of every variety and cut our engineering cloth to fit the coat.

FAVORABLE COST OF EXTENSIONS

Contracts for service need not be final until accepted by the higher executives of a company, and this provision goes a long way to protect an organization against entering into a distinctly unprofitable service. In this connection reasonable provisions must, of course, be established in regard to line extensions of any considerable length; but the present cost of copper wire and relatively low expense of running short overhead services justifies a pretty liberal attitude on the part of the central-station company. Even where a group of would-be customers at some distance from our lines desire service, it is for us to meet them on a reasonable basis, and if it is possible to make a fair agreement and get back the cost of construction in say four or five years, the word should be "go ahead."

Instead of wearing out slide rules in the sales department trying to analyze prospective new business to death, the industry will do better to play the game with enthusiasm and challenge the engineers to keep ahead of the growth of business if they want to hold their jobs. Customer ownership and the present lower cost of money offer no little aid to financing, provided the public feels that the local company is doing its utmost to provide service at fair rates and is making it just as easy as is humanly possible for the public to obtain such service. Instead of spending excessive time and exhausting brain cells in picking and choosing business, let the central-station commercial department cultivate the friendship of the contractor-dealer, "play square" with these potential "boosters" for additional loads and co-operate for more business. The saturation point is still too far from sight to justify a "stand-pat" policy.

Economical Increase of Distribution System Rating

How the West Penn Power Company Planned and Carried Out a Change-Over from 2,300-Volt Two-Phase to 4,000-Volt Three-Phase with Maximum Use of Old Equipment and Least Interruption of Service

THE central-station company with an overloaded distribution system usually has one of two remedies to apply. The first and perhaps the most natural is to add circuits or increase the size of copper in existing circuits. The second is to raise the voltage. A possible third remedy that applies only in larger communities is the construction of additional substations and splitting the system into smaller units. In the average small city this plan is usually too costly to consider. A typical case of the small-city problem is that of Connellsville, Pa., which is served by the West Penn Power Company. The city has a population of approximately 20,000 and is situated to the southeast of Pittsburgh. It is tied into the transmission system of the company through 25-kv. lines. One of the system generating plants is at Connellsville, the substation being at this plant. It is about 2 miles from this substation to the center of distribution in town, a rather long run for 2,300-volt circuits if a considerable amount of power is to be carried.

Originally the distribution system had been 2,300-volt, four-wire, two-phase. Some years ago changes were made so that three-phase power could be supplied, and some progress had been made in changing the system to full three-phase when a badly overloaded condition developed in the summer of 1921. Nearly 3,500 kw. in transformer capacity was installed, it being about equally divided between two-phase and three-phase service. One hundred and eleven power customers and 3,200 lighting customers served by 215 transformers were affected.

After a survey of the situation it was decided that the addition of circuits at the same voltage would not only involve a heavy cost but would soon produce a congestion in the streets that would be both undesirable and eventually impracticable. Additional substations were also impracticable, and a change to 4,000-volt, three-phase, Y-connected circuits was decided on as it would clean up the existing condition of poor regulation and leave the way clear for future expansion at the cost of only a few new circuits as the load should grow.

Not only was it necessary to make the change with

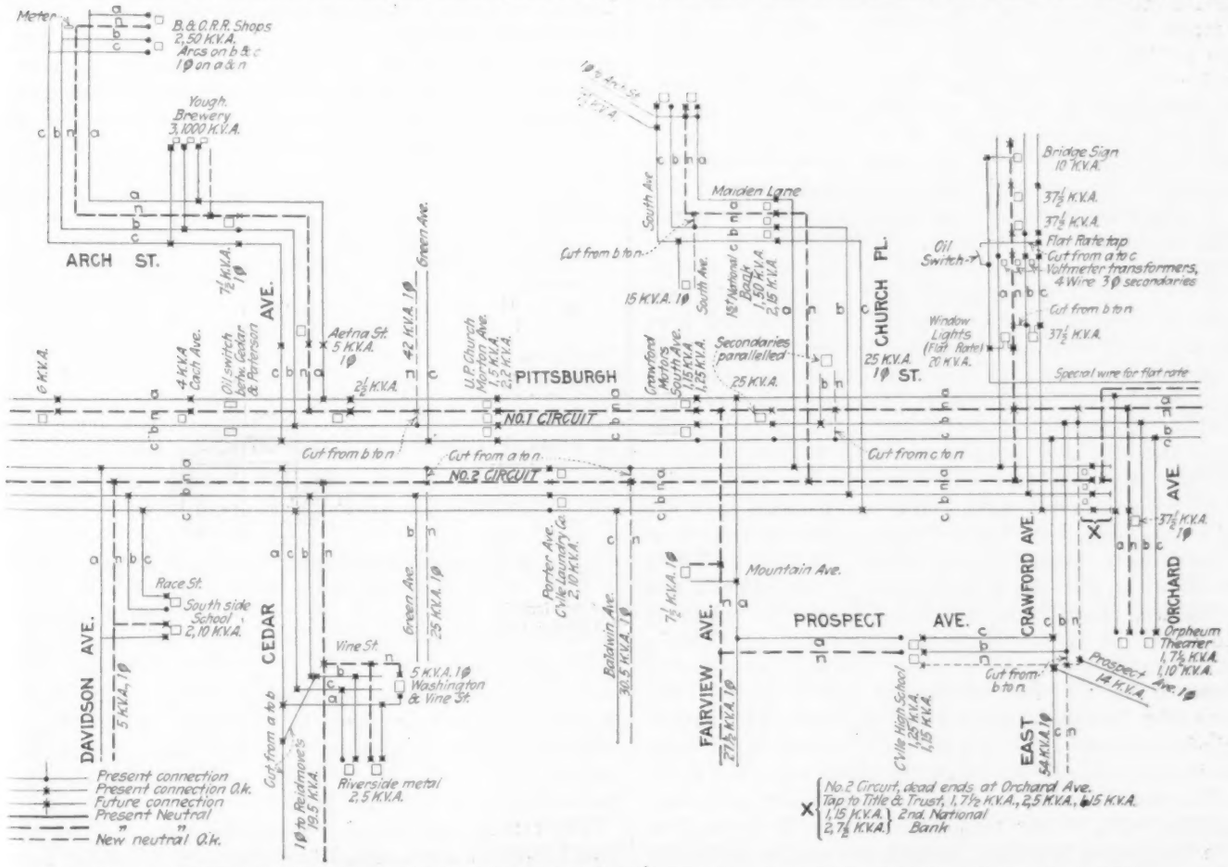
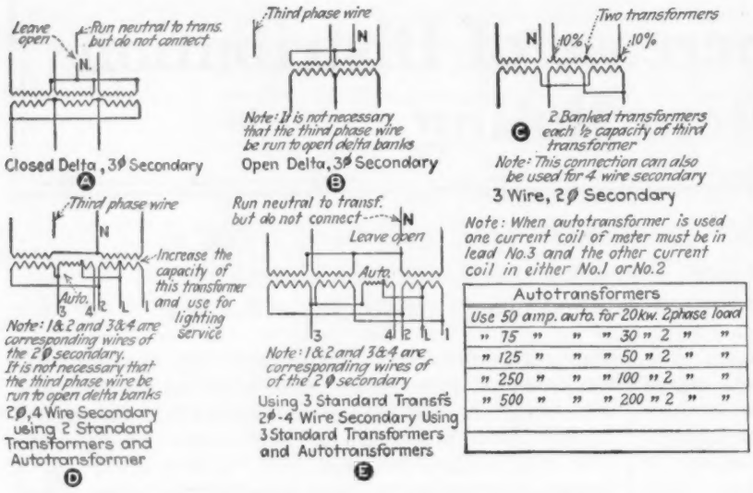

Meter
B. & O. R.R. Shops 2,50 K.V.A. Arcs on b & c 1ø on a & n
Yough. Brewery 3,000 K.V.A.
ARCH ST.
AVE.
Aetna St. 5 K.V.A. 1ø
42 K.V.A. 1ø
Green Ave.
U.P. Church Morton Ave. 1,5 K.V.A. 2,2 K.V.A.
PITTSBURGH
Crawford Motors South Ave. 1,15 K.V.A. 1,25 K.V.A.
Secondaries parallelled
25 K.V.A.
CHURCH PL.
25 K.V.A. 1ø ST.
Maiden Lane
South Ave.
15 K.V.A. 1ø
1st National Bank 1,50 K.V.A. 2,15 K.V.A.
Cut from b to n
Oil Switch
Bridge Sign 10 K.V.A.
37½ K.V.A.
Flat Rate tap
Cut from a to c
Voltmeter transformers, 4-Wire 3ø secondaries
Window Lights (Flat Rate) 20 K.V.A.
Special wire for flat rate
NO.1 CIRCUIT
NO.2 CIRCUIT
Cut from a to n
Cut from c to n
Race St.
South side School 2,10 K.V.A.
DAVIDSON AVE.
CEDAR
Vine St.
5 K.V.A. 1ø Washington & Vine St.
Riverside metal 2,5 K.V.A.
Cut from a to b
1ø to Realmove's 19,5 K.V.A.
Porter Ave. C'ville Laundry Co. 2,10 K.V.A.
Baldwin Ave. 30,5 K.V.A. 1ø
Mountain Ave.
PROSPECT AVE.
FAIRVIEW AVE.
CRAWFORD AVE.
ORCHARD AVE.
Orpheum Theatre 1, 7½ K.V.A. 1, 10 K.V.A.
Prospect Ave. 1ø 14 K.V.A.
C'ville High School 1,25 K.V.A. 1,15 K.V.A.
EAST
54 K.V.A. 1ø
Present connection
Present connection O.k.
Future connection
Present Neutral
" " New neutral O.k.
X No. 2 Circuit, dead ends, at Orchard Ave.
Tap to Title & Trust, 1, 7½ K.V.A., 2,5 K.V.A., 1,15 K.V.A.
1, 15 K.V.A. 2, 7½ K.V.A. 2nd. National Bank

FIG. 1—SECTION OF THE CONTROLLING DRAWING USED IN THE CHANGE-OVER OF THE CONNELLSVILLE SYSTEM


Leave open
Run neutral to trans. but do not connect
N
Closed Delta, 3ϕ Secondary
A
Third phase wire
Note: It is not necessary that the third phase wire be run to open delta banks
Open Delta, 3ϕ Secondary
B
Two transformers
10%
10%
2 Banked transformers each ½ capacity of third transformer
C
Note: This connection can also be used for 4 wire secondary
3 Wire, 2ϕ Secondary
Note: When autotransformer is used one current coil of meter must be in lead No.3 and the other current coil in either No.1 or No.2
Third phase wire
Increase the capacity of this transformer and use for lighting service
Auto.
Note: 1&2 and 3&4 are corresponding wires of the 2ϕ secondary. It is not necessary that the third phase wire be run to open delta banks
2ϕ, 4 Wire Secondary using 2 Standard Transformers and Autotransformer
D
Run neutral to transf. but do not connect
Leave open
Auto.
Note: 1&2 and 3&4 are corresponding wires of the 2ϕ secondary
Using 3 Standard Transfs 2ϕ-4 Wire Secondary Using 3 Standard Transformers and Autotransformers
E

Autotransformers							
Use 50 amp. auto. for 20kw. 2phase load							
" 75 "	"	"	"	30	" 2	"	"
" 125 "	"	"	"	50	" 2	"	"
" 250 "	"	"	"	100	" 2	"	"
" 500 "	"	"	"	200	" 2	"	"

FIG. 2—VARIOUS TYPES OF TRANSFORMER CONNECTIONS WERE NEEDED TO HANDLE THE MIXED TWO-PHASE AND THREE-PHASE LOADS

A and B are for closed and open delta service. D and E handle two-phase, four-wire service. C is e connection required for the interconnected two-phase motors found on the system.

the least possible disturbance to service, but under the plans it was necessary to wipe out the existing arrangement of primary circuits whereby either two-phase or three-phase service could be given and make these circuits four-wire, three-phase, with some method of handling the two-phase service from these new circuits to be worked out. This was done through the use of auto-transformers, as will be described later.

The system consisted of two main four-wire circuits from the substation. Either two-phase or three-phase service could be given, one of the wires being used as a teaser for the two-phase service. The teaser wire was utilized as the neutral for the new arrangement. Under the old arrangement the conductors had been placed haphazardly on the cross-arms, and it was decided that they should be rearranged so that the same cross-arm positions would be occupied by each conductor throughout the system. The neutral was placed so that it is on the left-hand pole pin when the observer stands with his back to the source of power. In order that there should be no mistakes, the entire system was laid out at the beginning of the study in map form, a section of this map being reproduced here (Fig. 1). It was corrected day by day as the study proceeded and plans to care for the various changes were decided on. The system of legends showing the existing connections, the changes to be made and the connections as they were to be finally is indicated.

While the individual arrangements for the service of all the consumers were shown on the map, this was not judged sufficient. Several types of transformer connections were needed to care for all conditions. These are shown in Fig. 2. A and B are for closed-delta and open-delta, three-phase service respectively, while D and E are for the four-wire, two-phase service. Certain motors on the system were found to have interconnected phases for which the transformer connection in C for three wire, two-phase service was required. In D and E auto-transformers with capacities as shown in the table were used to secure the necessary phase relations, while in the cases involved in C the transformers used were supplied with 10 per cent taps that could be used to give the proper relations, though there is a slight unbalance. This has not shown any practical effect that warrants avoiding its use. The same result could be obtained with transformers not having these taps, but at the expense of using another set of transformers as boosters.

Each consumer's installation was taken and small drawings were made up showing the connections of the transformer bank both as they existed and as they were to be when the work was complete. Samples of these sheets are shown in Fig. 3. Even these were not deemed sufficient for the linemen to work from in making the changes necessary at the cut-over period. Hence shipping tags were cut to the shapes shown in Fig. 4 and tied to the conductors between which connections were to be made as indicated. As a result the linemen had only to follow the tags to make the necessary connections either at transformer installations or other points. One point that was overlooked in marking the conductors was the fact that some few conductors were to be cut entirely. While no trouble resulted, it seems advisable in future cases to provide a tag marking for all conductors so that no possible confusion can result.

In handling other situations where two-phase service must be cared for, an alternative method has been developed that seems to offer some advantages. It involves a standard phase-changing transformer in which the connections are changed from that shown in A, Fig. 5, to that in B, so that the service can be carried to the customer's premises as three-phase and metered as such. Phase changers can be used to handle the older installation, and as new motors are added or old ones displaced they can be changed to three-phase, thus providing for a gradual and natural change to complete three-phase. The same thing might be possible with the Connellsville installation, though at the expense of considerable complication in wiring and a possibility of some mix-up

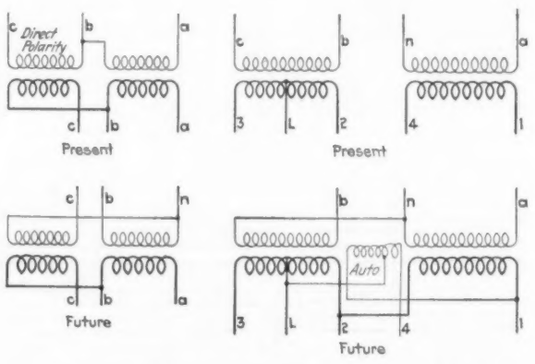


FIG. 3—MANNER IN WHICH "CUT-OVER" OF TWO POWER CONSUMERS WAS WORKED OUT

One drawing was made for each bank of transformers affected. Shipping tags cut to the forms shown in Fig. 4 were used to mark the connections to be made on the lines. One of the proper shape was placed on each wire to be changed, showing the men just what to do.

in meter connections if care be not taken. This scheme is being tried as an alternative or for joint use with the one at Connellsville, the decision depending on the experience that is had with both methods.

The system was supplied from the 25-kv. system by two 2,500-volt T-connected transformers. A third was added, and the three were connected for 4,000-volt Y,

four-wire service. One of the essentials in the change-over was that no power consumers' motors should be reversed. To see that no reversal occurred in the changes at the substation a small motor was used as a check for phase rotation. This, combined with the method of laying out the work to be done and marking the connections to be made by means of the specially cut shipping tags, brought the result desired. This temporary motor used as a check on phase rotation was made more necessary because at the cut-over period some revamping of the substation interior work was undertaken. A temporary bank of transformers was used for a few hours to give Sunday service.

The entire job was planned and executed in a very short period of time. Study on the plan began on Nov. 1, 1921, and the final cut-over was made on Dec. 11 following. Seven gangs with a maximum of three men per gang were formed to handle the eighty-eight distinct jobs that had to be done during the cut-over. Each gang had from five to sixteen pieces of work to handle. These were so scheduled that each gang completed its work in a given district and reported back to a central point before the work in another district was commenced. In this way the cut-over was completed, district by district, and service restored. The longest period that any district was out was eight hours. The work was started at midnight, and at 8:35 a.m. three-fourths of the service was back. Part of the work was held back during the morning church service hours to avoid interference with religious services. At four o'clock in the afternoon the entire service, including the permanent substation transformers, was restored, leaving only the clean-up work to be done at leisure.

In carrying out the work not only was the field work as laid out carefully and repeatedly checked against the drawings, but the gangs responsible for the cut-over work had each their schedules and were required to go over the work on the day preceding the cut-over and satisfy themselves that all preparations had been cor-

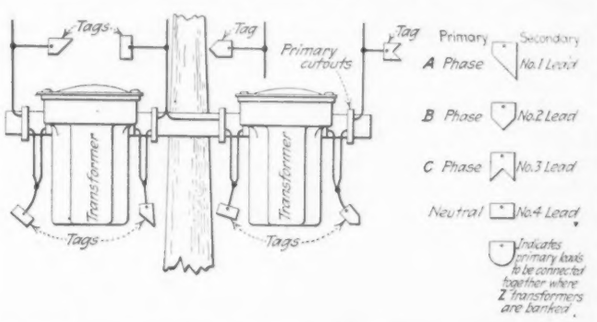


FIG. 4—SPECIALLY CUT TAGS USED TO INDICATE CHANGES IN TRANSFORMER CONNECTIONS NECESSARY IN "CUT-OVER"

rectly made and that all needed material was on hand, thus preventing delays. Among other things that it was necessary to do in preparing for the cut-over was to check the polarity of all transformers supplying two-phase service. This was done with a potential transformer with marked leads and a voltmeter.

The work of cutting over was done almost altogether in the dark. Each gang had with it an automobile that was equipped with a spotlight and an extra storage battery to furnish light for the work. While the arrangement worked to fair satisfaction, an electric lantern supplied by two dry cells will be used on future work to avoid difficulty due to the sharp shadows cast by a spotlight. These lanterns are light and can be easily handled by the men on the pole. The spotlights used could have been taken from the cars and brought closer to the work, but no advantage was found in so

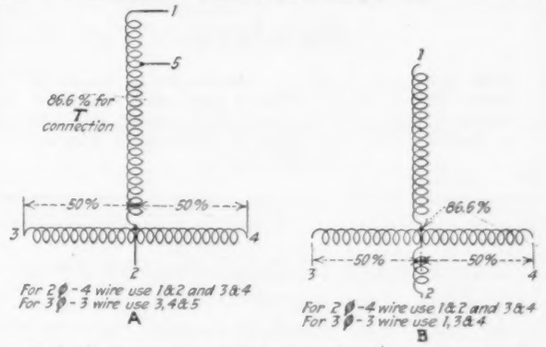


FIG. 5—STANDARD PHASE-CHANGING TRANSFORMER FACILITATED CHANGE-OVER

Arrangement for use on three-phase, two-phase lines is shown in A. By connecting as in B service may be carried into the consumer's premises and metered as three-phase. The phase changer is placed on the two-phase circuits. Either three-phase or two-phase service is available, and three-phase can be substituted as changes in equipment are made.

doing. During the cut-over job the opportunity was taken to do considerable clean-up work on the system. This prolonged the shut-down, which otherwise could have ended before 8 o'clock in the morning.

The big advantage of the 4,000-volt Y system in a case of this kind is the possibility of using all the old equipment. Insulation is adequate, and the only changes in transformers and other equipment are those needed to care for load conditions. The change brings a theoretical increase in capacity of the circuits that is three times the original capacity, though, owing to practical conditions, the actual increase is probably slightly less than this figure. In the present case the circuits in a badly overloaded distribution system were made adequate to carry the existing load, and future increases can be cared for by the addition of one circuit at a time as the demands warrant. The entire change was made at an expense between one-third and one-half what would have been required if the lower voltage had been maintained and the capacity of the system built up to handle the load by adding copper to the existing circuits or installing new ones, and either of the alternatives would have involved considerable expenditure and some problems in supporting structures. The change as made has probably involved a minimum of operation difficulties on the system, because the men can handle the lines exactly as before. In this case, after several months of operation, none of the difficulties which, because of the complication imposed by the combination of two kinds of service, might have been looked for has arisen.

In concluding, it is well to remember that a considerable part of the complication of the work was due to the fact that the entire system is in a transition period from the older two-phase system to three-phase. The two-phase service is in process of elimination as old equipment wears out and is replaced. A change from an ordinary three-wire, delta-connected, three-phase system to a four-wire, Y-connected system could be handled by exactly the same method, with less possibility of troubles to be encountered. The story of the work points the way to make an economical change in any distribution system before it becomes necessary to consider the higher distribution voltages that will naturally involve a shift in all service equipment.

Letters from Our Readers

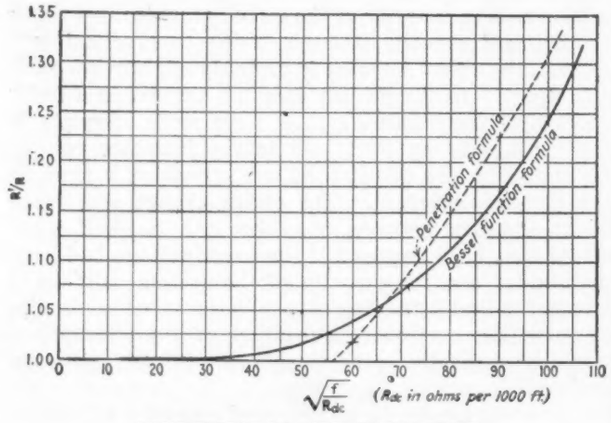
This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Bessel Function for Calculating Skin Effect

To the Editors of the ELECTRICAL WORLD:

In the editorial of March 11 on skin effect in cables it is stated that "One of the theoretical formulas referred to above indicates that a close approximation to the skin effect may be had by assuming that all of the current carried is limited to a surface layer of definite thickness, depending on the frequency. This applies to solid circular conductors."

Since a definite comparison of the results of the penetration formula with those of the Bessel function formula has not, to my knowledge, appeared in any recent publication, perhaps readers of the ELECTRICAL WORLD may be interested in the accompanying curve, giving this comparison up to 30 per cent increase of resistance, which is the range required for large 60-cycle cables. It can be seen that the penetration formula gives 36 per cent increase in resistance where it should



SKIN EFFECT IN SOLID ROUND WIRE

give 30 per cent. It gives 26 per cent where it should give 20 per cent, and it gives zero per cent where it should give 3 per cent.

Such large discrepancies show that the penetration formula does not give a "close approximation" for the range considered. If a calculation is to be of use in deciding questions of design of large cables, it should not give errors as large as 6 per cent in a quantity which amounts to not more than 30 per cent. The same statement applies to test results having discrepancies between duplicate readings amounting to several per cent. The penetration formula was originally published by physicists who were discussing skin effect at high frequencies with increases in resistance of several hundred per cent. Under such conditions, the error due to the penetration formula is quite small.

Canadian Westinghouse Company, H. B. DWIGHT.
Hamilton, Canada.

Italy's Hydro-Electric Troubles Are Over

To the Editors of the ELECTRICAL WORLD:

Referring to an article in your issue of March 25 (page 579) concerning the power shortage said to threaten the industrial zone in north Italy, may I inform you that the danger reported to the Department of Commerce and the pessimistic deductions drawn are now things of the past? The reports were, no doubt, correct at the time they were made, if they referred to the situation existing in the last months of 1921, but by the time they reached you through the official channels they were already superseded.

You give April 1 as the peak of an unprecedented power shortage. As a matter of fact, that was precisely the date when the last restriction on the use of light and power was repealed and electrical transportation, illumination and industrial exploitation were again back to "normalcy." A few weeks ago the Genoa-Modane electric railroad was inaugurated and immediately opened to traffic. This would seem an eloquent contradiction of your information that electric traction was to be supplanted by steam locomotives.

We faced an indeed unprecedented power shortage during 1921, but by December we had already overcome all difficulties and commenced to increase our output gradually and constantly, so that by March, 1922, the production was once more normal. This result we attained by means of interprovincial connections, of new lines thrown across the mountains in record-breaking time, and of a rational distribution of power when it was scarce. G. G. PONTI,

Società Idroelettrica Piemonte, Managing Director.
Turin, Italy.

Importance of Familiarity with Apparatus

To the Editors of the ELECTRICAL WORLD:

Frank H. Broome in his article on "Preparation Necessary for Tests on Steam Equipment" in the ELECTRICAL WORLD of Feb. 4 has left out what I believe to be an important preparation for making any test. This is to familiarize one's self with the apparatus that is to be tested.

It is absolutely necessary to get some kind of a drawing or blueprint of the boiler or turbine or other apparatus to be tested, showing the dimensions that will affect the quantities to be measured in the test, the arrangement of the piping, and the proper points for inserting or connecting the measuring instruments. It is also very desirable for the person who will superintend the test to look over the apparatus, because he can see more clearly just where he can best set up his measuring instruments, scales, etc., what readings can be taken by the same man, what pipe connections must be blanked, and so forth.

By familiarizing himself beforehand with the installation he can get the test under way more promptly, after his observers are at their stations and conditions are right for starting the test, and with less chance of having it spoiled by the neglect of some precaution.

When a test is started during daylight and is to be continued after dark, portable lights should be rigged up where the readings are to be taken, or else the observers must be provided with good flashlamps. It is well to place a table under a good light to make it possible to record data. J. J. STORROW, JR.,

Mechanical Technical Engineer Generating Department.
Edison Electric Illuminating Company of Boston.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

New Pole-Type Transformers.—E. LAPP.—A description of the most important features of a new series of oil-cooled three-phase transformers rated at from 5 kva. to 150 kva. In spite of their relatively small size, the machines are equipped with oil conservators, a circumstance no doubt due to the rather high price of transformer oil in Europe. A tap-changing switch or ratio adjuster permits changing the voltage taps without removing the cover of the machine. All sizes are placed in corrugated steel tanks with cast-iron base and band. —*Brown-Boveri Mitteilungen,* March, 1922.

Theory of the Single-Phase Generator.—G. SHIMIDZU and K. ITO.—On the assumption that the field poles are non-salient, that the entire iron core is finely laminated, and that the flux in the armature and in the field windings fluctuates in a pure sine wave form, the instantaneous maximum and effective values of steady short-circuit current are calculated. In the latter part of the paper the author fully explains the phenomena caused by short circuits taking place between two line terminals in one, two or three-phase generators.—*Journal of the Institute of Electrical Engineers of Japan,* March, 1922.

Generation, Transmission and Distribution

Pilot Circuits.—ALLAIN LAUNAY.—Description of the way in which pilot circuits have been developed by means of experiments at the Central Laboratory of Electricity so that by their use any number of lamps or appliances energized by an urban network may be controlled simultaneously. Street lamps, transformer stations, meters for variable rates where time registration is effected, motors and heating appliances are among the apparatus to which the pilot circuits have been successfully adapted.—*Bulletin de la Société Française des Electriciens,* Vol. 1, No. 10.

Buitreras Hydro-Electric Power Station on the River Guadiaro.—An elaborate description of this hydro-electric development in south Spain, profusely illustrated with line drawings and photographs. The plant has a capacity of 6,000 kva. and generates power at 5,000 volts and 50 cycles. The alternators, transformers and switching layout are described in detail.—*Brown-Boveri Review,* January, 1922.

Lamps and Lighting

Motion-Picture Projection with "Mazda" Lamps.—H. H. MAGDSICK and C. E. EGELER.—The use of "Mazda" lamps for the projection of motion pictures in theaters is attended by numerous advantages both in the results obtained on the screen and in the projection room. Maximum satisfaction is realized when each element in the projection system is designed and adjusted for this light source. The bulletin discusses (1) the optical principles involved in the projection of motion pictures by "Mazda" lamps, (2) the properties of the component optical elements, (3) "Mazda" lamps and their correct application, and (4) the complete operating equipment. Under the first general head are considered the image formation, objective lenses, relation of light on screen to light through film, requirements for uniform screen illumination and the purposes of the condensing lens and spherical mirror. The second part explains each element of the projection equipment and gives the purposes of each. The third considers the sizes of lamps available, with their operating characteristics. Under "complete operating equipment" are discussed the requirements and installation of the equipment and also the adjustment of the light source and mirrored reflector.—*Bulletin 33-A of National Lamp Works of General Electric Company.*

Traction

Electrification of Main-Line Railroads.—S. T. DODD.—The author gives several examples of the electrification of steam railroads to illustrate the extent to which interest has been excited throughout the world by this very important engineering development. Among the partly electrified railroads in this country that he instances are the New York Central, the Norfolk & Western and the Chicago, Milwaukee & St. Paul, and he also describes the electrification of the Great Northern Railway where it passes through the Cascade tunnel. He gives a list of companies now seriously considering a change from steam to electric operation.—*News Letter of the Princeton Engineering Association,* March, 1922.

Installations, Systems and Appliances

Electric Drop Hammer Operating on Induction-Motor Principle.—P. TROMBETTA.—In this article an electric hammer of the induction-motor type is described. Instead of the usual arrangement of concentric armature and field, the slots are punched on long strips of iron in a straight line, which makes the field and armature parallel. The rotating fields of an induction motor are here replaced by magnetic fields moving in a straight line. The author claims that this hammer is more flexible, handier, cheaper to operate and cheaper in first cost than the board hammer with the flywheel. —*Journal of the A. I. E. E.,* April, 1922.

Operation of a Drum-Type, Elevator-Machine Alternating-Current Motor Controller—WILLIAM ZEPERNICK. —The functions of the different parts and circuits of an elevator controller operating a single-speed, slip-ring type of alternating-current motor are described. This type of motor compares favorably in compactness and durability with the single-speed direct-current motor. One of the features described is the means for preventing the operator from running the elevator on any other than high speed, this being insured by the car switch having but one running position for each direction.—*Power,* Feb. 21, 1922.

Passenger and Freight Transfer in Piers and Warehouses.—L. S. GATTER.—This marks the beginning of a series of articles dealing with material handling.

Other articles will cover factories, office buildings, hotels, apartment houses, etc. The series refer in particular to the elevator equipment problem, which has long been one of the most difficult for architects and engineers. The purpose for which buildings are to be used determines the equipment required to accommodate the passenger and freight movement. Transfer equipment in the modern pier and warehouse includes the machinery used in loading and unloading ships, freight cars and motor trucks, as well as the equipment used in vertical movement, such as automatic operatorless elevators. The author discusses in this article the pier dimensions necessary for transportation of freight from or to the ship, loading and unloading freight cars, cranes, hand and motor trucks, and exterior and interior elevators.—*News Letter of Princeton Engineering Association*, March, 1922.

Wires, Wiring and Conduits

Maximum Rating of High-Voltage Cables.—M. HÖCHSTÄDTER.—In a paper by Clark and Shanklin (*Proceedings A. I. E. E.*, 1919) these authors maintained that no dependable high-voltage cable can be built for more than 1,950 volts per millimeter of insulation between the conductor and the lead sheath. At this point a so-called ionization point was said to be reached beyond which it would be unsafe to go. The present author has carefully tested a number of existing cables in use in Holland and Germany, and he takes strong exception to the above figure. There have been cables in successful use for several years, operating under a stress of from 3,000 volts to 13,300 volts for each millimeter insulation, which is six and eight-tenths times that permissible according to Clark and Shanklin. For modern cable manufacture values between 3,000 volts and 4,000 volts per millimeter are very conservative, the value depending upon local ionization and upon the chemical stability of the dielectric under prolonged static stress and high temperature. Improved manufacturing methods and the choice of dependable and stable insulating materials will no doubt permit this critical voltage to be further increased. Careful measurements showed also that the dielectric loss in a high-tension cable diminishes with rising temperature, reaches a minimum at about 50 deg. and then rises again.—*Elektrotechnische Zeitschrift*, Feb. 16, 1922.

Electrophysics and Magnetism

Length-Voltage-Current-Pressure Characteristics of Normal Arcs for Different Electrode Materials.—W. N. EDDY.—The results of the investigation carried on by Dr. Steinmetz and Messrs. Ayrton, Duddell and Childs are combined and given in a usable form in this article, together with curves and illustrations.—*General Electric Review*, March, 1922.

Ionization by Cumulative Action.—K. T. COMPTON.—Prof. F. Horton and Miss A. C. Davies have proved the importance of radiation in the production of ionization in certain cases in which ionization by direct impact is impossible or at least improbable. These cases include the formation of arcs in metallic vapors and in helium at voltages less than their minimum ionizing potentials. Experiments conducted at Princeton University to test the possibility of the production of similar low-voltage arcs in multi-atomic gases have indicated that it is impossible to strike arcs in such gases at less than their minimum ionizing potentials. —*Philosphical Magazine (London)*, March, 1922.

Units, Measurements and Instruments

Electrical Porcelain Research.—M. H. HUNT.—Research work in this subject usually includes the following considerations: (1) Properties of the various ingredients that enter into the porcelain body; (2) properties of the body as a whole in the plastic state, including shrinkage, cracking and strength; (3) burning behavior, including cracking, vitrification, shrinkage, specific-gravity changes, color, etc.; (4) properties of the fired porcelain, such as impact resistance, tension, compression and shear, thermal expansion, etc. The means for carrying on these various tests are described. —*Electric Journal*, March, 1922.

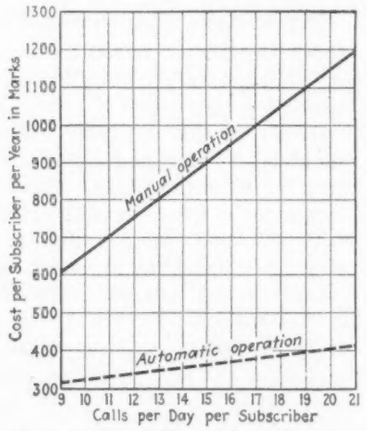
Electrochemistry and Batteries

Oxide-of-Copper Battery That Can Be Regenerated.—M. LEBLANC FILS.—The oxide-of-copper battery, although known for many years, has never received the industrial applications that it merits because of its robustness, its qualities of conservation and, above all, the fact that it maintains its maximum voltage during almost all the time it is discharging. The reason for its not being employed more extensively has been its cost, which has not permitted competition with the manganese-dioxide type. The author describes an oxide-of-copper battery which can be regenerated and will, he believes, replace the manganese-dioxide battery for many uses.—*Bulletin de la Société Française des Electriciens*, Vol. 1, No. 10.

Telegraphy, Telephony and Signals

The Economy of Small Automatic Telephone Exchanges.—M. LANGER.—The author shows the great economic advantages of the automatic telephone system

COST OF TELEPHONE SERVICE FOR 60,000 SUBSCRIBERS



over hand switching. Assuming a life of twenty years for both systems and a return of 5 per cent on the invested capital, the accompanying table, applying to present German conditions, will be of interest.—*Siemens Zeitschrift*, March, 1922.

	Manual	Automatic
Cost of repair parts per one year, per cent of investment	9	1.6
Cost of energy per year per subscriber, marks	3.00	9.00
Total cost of operation of an exchange with 400 subscribers, per year per subscriber, marks	450.00	270.00

Amplification of Weak Alternating Current.—H. BARKHAUSEN.—The author discusses in this portion of a continued article on wireless transmission the grid circuit and input transformer. He explains how the input transformer and the capacity between the grid and the anode affect the power supplied to the grid circuit.—*Radio Review*, February, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Chamber of Commerce to Bring Coal Producer and Consumer Together

A DRIVE is being made by the Chamber of Commerce of the United States to bring together on Tuesday next, May 16, representative groups of producers and consumers of coal. During all next week the chamber will hold its annual convention in Washington. It was recently pointed out in official quarters that there is no restraint of trade if producers and consumers sit down around the table together. On that suggestion the chamber has acted.

An address on the subject "The Coal Industry and Government Regulations" will be delivered by Senator Howard Sutherland of West Virginia. The remainder of the meeting will be devoted to a discussion of three pertinent phases of the coal business—distribution, transportation and labor.

McClellan Urges that Engineering Board Consider Muscle Shoals

ACTING on the invitation extended to the presidents of all the national engineering societies by the Senate committee on agriculture to appear before it and give their views on the Muscle Shoals project, Dr. William McClellan, president of the American Institute of Electrical Engineers and a member of the executive board of the Federated American Engineering Societies, visited Washington for this purpose last Tuesday, May 9. Dr. McClellan, who was the first of the technical association executives to act upon the invitation, made in the course of his testimony two main recommendations —that the existing construction and equipment at Muscle Shoals be protected to prevent its deterioration, and that an engineering board of review be appointed to report to Congress a general plan of procedure.

Dr. McClellan bound himself to place at the disposal of Congress a committee of engineers with commercial experience who would recommend a general plan for the handling of the project from a business standpoint. He said he would arrange, through the American Institute of Electrical Engineers or through the Federated American Engineering Societies, for the services of such a committee which would be composed of disinterested men of thoroughly established reputation. He told the committee that the government should not act except on the basis of unbiased and competent professional and business advice. "It is perhaps not unfair to say," he asserted, "that all those engineers and business men who have made detailed studies of the project have done so for some reason of their own and did not look at it from the government's standpoint. The disposal of Muscle Shoals is not a technical engineering proposition. It is a commercial matter. The only way for the government to get an impartial review of the commercial and engineering features of the situation is for the committee of the Senate and the committee of the House jointly to request a group of not less than five engineers who have had adequate commercial experience in large projects to take all of the data, statements and reports which have been submitted and report to the committees what the government should do.

"The government under no circumstances," continued Dr. McClellan, "should alienate its nitrate plants until an adequate plan is agreed upon for the completion of these plants or the construction of nitrate plants at some more favorable points, should such places be found. During the period of investigation the works at Muscle Shoals can be adequately protected against deterioration. Such protection of interrupted construction work is very common among commercial companies."

Savings Banks Association Considering Public Utility Investments

ENACTMENT of new state laws or the amendment of existing laws throughout the country so that savings banks may have the legal right to invest in sound public utilities securities was urged at the closing session of the third annual conference of the National Association of Mutual Savings Banks at Atlantic City last week. At present, it was asserted at the conference, the laws in a majority of states prohibit investment in such securities of moneys held by savings banks, trust companies or trustees. This was declared to prevent local money being invested in local utility undertakings, thus sending into other fields the money that might be invested at home.

"The investment bankers of the country recognize that the expansion of utilities and the extension of their services are essential to the continued commercial prosperity of the country," said H. M. Addinsell, of Harris, Forbes & Company of New York City. "Therefore we naturally are looking for a wider distribution of these securities which will make that possible, and the help of the savings banks is greatly to be desired as a stimulus to the raising of the tremendous amount of money necessary to develop the country."

Asserting that "every dollar invested in sound public utilities securities is reflected in increased property value, increased business, increased prosperity and general well being," Martin J. Insull, vice-president of the Middle West Utilities Company of Chicago, who represented the National Electric Light Association before the bankers, said that the public utilities of the country represent an investment of $16,000,000,000, and that the electric light and power industry alone must raise and invest annually $750,000,000 for the next several years to keep pace with demands for service. Thus far in 1922, he stated, this one utility industry has started development projects and extensions which will require

more than $200,000,000 to complete and which are giving employment to thousands of men.

"The electric light and power industry represents an investment of $5,000,000,000, these securities being owned by more than 1,500,000 Americans, and the gross income of the industry a billion dollars a year," said Mr. Insull. "There is every reason why the public's savings should be invested in these utilities," he continued. "They supply service which the public requires and uses in its business and social life. The whole economic structure of the country depends upon the successful operation of the utilities. The operators are merely the trustees of the money of these nearly two millions of investors and are quasi-public servants. The public, through its regulatory bodies, says what the standards of this service shall be, what rates shall be charged for the service and what securities the utilities may issue in order to supply the equipment which will give the service demanded."

The investor's phase of the question was presented by J. M. Wilcox, vice-president of the Philadelphia Saving Fund Society of Philadelphia, who related in detail the investigation which should be made to determine, before purchasing, the stability of the properties back of the securities offered.

Other representatives of the N. E. L. A. present at the conference were its president, Milan R. Bump of Henry L. Doherty & Company; its vice-president, Frank W. Smith of the United Electric Light & Power Company, and its executive manager, M. H. Aylesworth.

Announcement was made at the meeting that a conference committee representing both associations is now studying the question.

Senate Committee Against Accepting Private Muscle Shoals Offers

EVENTS in Washington during the past week continued to point to the prospect of a deadlock on Muscle Shoals legislation. At the hearings before the Senate committee on agriculture and in a statement made public by him separately, Senator Norris, chairman of that committee, made it plain that the committee will not recommend the acceptance of any of the private offers for the development, lease or sale of the nitrate and power projects of the government. Instead, he announced, he will press, with the support of the majority of his committee, for an appropriation rider for $7,500,000 for at least one year's more work toward the completion of Wilson Dam by the government. Against this there was balanced again this week the reiterated opposition of Chairman Kahn of the House military affairs committee to the expenditure of any more government money at Muscle Shoals without first ascertaining what is to become of the government's present $107,000,000 investment there. In this Mr. Kahn is supported by a majority of his committee. While the Senate continued to hold public hearings, the House committee remained in executive session framing requirements which, it is expected, will throw out all private bidders.

There have been a number of test votes in the executive sessions of the House committee, one of the most important having been a division of eleven to ten on the acceptance of Mr. Ford's most recent modification to his offer, under which he would agree to take over the Gorgas plant at the Warrior River station of the Alabama Power Company under the provision reported in the ELECTRICAL WORLD last week.

It is understood that there is to be a reconsideration of this vote at the request of several members who voted by proxy, as the effect of the vote would place the committee in favor of reporting out a lawsuit, a position which it is most unlikely its members could support in general debate on the floor of the House.

Further attention to this feature of the fight in regard to the Ford offer was brought about in a hearing which was granted Wednesday by the Attorney-General to the representatives of the Alabama Power Company, Chairman Kahn of the military committee and the Judge Advocate General of the army. An opinion was expressed by the latter official that the contract of the power company to purchase the government interest in the Gorgas plant was null and void, and even the supporters of the Ford proposal on the military committee felt that there should be no vote in committee of a definite character until this hearing had been held and a decision by the Attorney-General rendered. Such an opinion is now expected momentarily.

As this is telegraphed from Washington the question of what kind of a guarantee to manufacture fertilizer at Muscle Shoals must be exacted in connection with the Ford offer is engaging the attention of the committee. It is felt in many quarters close to the military committee that the policy adopted by the committee in this respect will be one of rigid protection to the farmers.

On the Senate side, Chairman Norris is frankly denouncing the Ford offer, a position in which he has the support of more than a majority on the committee. Characterizing the offer as "unconscionable," he announced that "no corporation will get Muscle Shoals" with his consent.

Six Groups of Papers Make Up A. I. E. E. Convention Program

PLANS for the annual convention of the American Institute of Electrical Engineers, to be held at Niagara Falls, Ontario, June 26-30, will probably be completed within the next two weeks. The annual business meeting of the Institute will be held in New York on Friday of the coming week.

Five main groups and one miscellaneous group make up the convention technical program. As yet they have not been assigned to sessions. The groups and the papers are as follows:

A. "The New Queenston Plant of the Ontario Hydro-Electric Power Commission":

1. "The Queenston Plant," by F. A. Gaby.
2. "Queenston Generators—45,000 Kva.," description of the Canadian General Electric Company's generator—187½ r.p.m., vertical, 25-cycle, 12,000-volt, three-phase, by B. L. Barns.
3. "Queenston Generators," by R. A. McCarty.
4. "Design Features of Main Power-House Transformers in Queenston Station," by M. E. Skinner.

B. "Standards of Rating of Generator Insulation":

1. "Questions Relating to Standards of Rating, with Particular Reference to Large Machines Using Class B Insulation," by F. D. Newbury.
2. "Probable Values of Conventional Allowance for Alternating-Current Generator Stator Windings," by F. D. Newbury.
3. "Temperature Limits in Large Machines," by P. Torchio.

C. "The Baltimore Oil Circuit-Breaker Tests" (the highest power tests ever made):

1. "Baltimore Oil-Circuit-Breaker Tests," by H. C. Louis and A. F. Bang.
2. "Interrupting Capacity, Tests of General Electric Oil Circuit-Breakers at Baltimore," by J. D. Hilliard.
3. "Tests on Westinghouse Oil Circuit-Breakers at Baltimore," by J. B. MacNeill.

D. "Symposium on Education from Employer's Standpoint":

1. "Suggestions Concerning the College Education of an Engineer," by Carl Hering.
2. "Training for Character," by A. M. Dudley.
3. "Some Suggestions for Possible Improvement in Methods of Engineering Education," by B. G. Lamme.
4. "What May Be Done by Engineering Schools Better to Prepare Students for Railway Work, with Special Reference to the Telegraph and Telephone Department," by I. C. Forshee.
5. "Education," by S. E. Doane.
6. "Principles of Engineering Education," by P. Torchio.

E. "Electric Cables":

1. "Dielectric Losses and Stresses in Relation to Cable Failures," by D. W. Roper.
2. "On the Minimum-Stress Theory of Cable Breakdowns," by D. M. Simons.
3. "Determination of Temperature of Electrical Apparatus and Cables in Service," by E. J. Rutan.
4. "Effect of the Composite Structure of Impregnated Paper Insulation on the Electric Properties," by W. A. Del Mar and C. F. Hanson.

F. "Miscellaneous Group":

1. "Higher Steam Pressures or Pulverized Coal?" by F. A. Scheffler.
2. "The Economics of Direct-Current Railway Distribution, with Particular Reference to the Automatic Substation," by L. P. Crecelius and V. P. Phillips.
3. "The Two-Stage Current Transformer," by H. B. Brooks and F. C. Holtz.
4. "Two Thousand Tests on the Dielectric Strength of Liquid Insulation," by J. L. R. Hayden and W. N. Eddy.
5. "A General Law of Electromagnetic Forces," by Carl Hering.

Study of Economics Urged in Engineering Colleges

AT THE close of the second conference on commercial engineering held at Pittsburgh on May 2 under the auspices of the committee on commercial engineering of the United States Bureau of Education a statement was adopted embodying principles expressive of the proper aims and purposes of educational institutions and industrial organizations. Stated briefly, faculties were urged to give their students an adequate conception of production, distribution and finance. Commercial and business schools on the other hand are urged to give their students an introduction to the elements of engineering. Research to eliminate waste in material and human resources was recommended.

The conference recommended further that colleges of engineering and of business adopt the following procedure in developing students:

1. Secure the co-operation of industry in defining standard terminology and specifications of the requirements of industry.
2. Analyze the specifications of the requirements of industry to determine what are the fundamentals that must be taught, and organize the instruction accordingly.
3. Study and experiment with ways and means of discovering native bent and of measuring proficiency, that every student may be guided into a career of maximum achievement.

Large and Enthusiastic Convention Foreseen by President Bump

FROM all indications the Atlantic City convention of the National Electric Light Association next week, President Milan R. Bump said to a representative of the ELECTRICAL WORLD on Wednesday, will be the largest and most enthusiastic meeting ever held by the association. Already the advance reservations are taxing the hotel accommodations. Some of the principal Eastern companies are taking the opportunity to send

MILAN R. BUMP
President N. E. L. A.

large delegations for a day or two. In addition, Mr. Bump pointed out, the general business tone is better this year. This is especially apparent, he said, in the investment situation.

"It has been possible," Mr. Bump said, "for electric light and power companies to secure money since the first of the year on a favorable basis and a much lower interest yield. This means that the utilities can now go ahead with their plans for extension of service.

"From all that I can learn I am convinced that there is more new work under way and definitely planned than at any previous time in the history of the electrical industry. Furthermore, I see several years of very rapid growth in the electric light and power field. Why, at the present time the total power consumption is only about 10 per cent of existing possibilities."

The biggest thing on the program, Mr. Bump said, is the business development campaign, to the discussion of which one whole session will be devoted.

"This is a permanent co-operative movement," declared Mr. Bump, "carried on by all branches of the industry. Its backbone is the local organization. One of its aims is to get the local electric light and power company to take the lead in each community in the formation of local electrical development leagues. It becomes in that way a systematic means for promoting electricity in all its ramifications."

Mr. Bump mentioned the important progress that had been made by the co-operative committee with the American Telephone & Telegraph Company in inductive interference. There is now complete agreement, he said, as to principle and practice, and there only

remains the work necessary to adopt working specifications. In working out this joint agreement, Mr. Bump said, the co-operation of the telephone officials was remarkable.

One of the things the association has done this year which Mr. Bump expects will be of considerable interest is the co-operative work with the National Association of Mutual Savings Banks. An effort is being made to have state laws changed so that prime utility securities may become legal investments for savings banks and trust funds.

Attention was also called by Mr. Bump to the exhibits, the first since 1919. These are of an educational nature and are arranged in such a way as to bring out their greatest value.

State Department Revives German Patent Convention

AFTER an extended study of all the ramifications of the proposal that the patent convention of 1909 with Germany be allowed to lapse, the State Department decided to revive the convention, and notice to that effect was transmitted to the German authorities prior to May 11, which was the time limit for such notification. The revival of this convention gives the holders of American patents registered in Germany immunity from the working clause in the German patent law.

Manufacturers of machinery in the United States were among those who were most strongly in favor of reinstating the convention with Germany. It was asserted that it would cost machinery manufacturers millions of dollars to undertake the manufacture of their patents in Germany. The electrical industry especially, it was stated, would have been affected adversely had the convention not been continued.

Strong pressure was brought by the War Department and the chemical industry against the revival of the convention. The War Department is anxious to secure the enactment of a working clause to apply to all patents registered in the United States. Germany has a large number of patents registered in this country which are not being worked.

Yale University's Meter Course Has Public Policy "Slant"

PUBLIC relations as they concern electric metermen, in addition to his technical problems, were dealt with in a successful short course in metering which closed on April 22 at the Dunham Laboratory of the Sheffield Scientific School, Yale University, New Haven, Conn. Forty-nine men from New England, New York and New Jersey attended. The technical program covered principles of alternating current and machinery, principles of metering, laboratory tests and field work. Among the speakers were Profs. Scott, Morrow, Wilson and Warner of the Yale staff, assisted by Messrs. Wittig, Haugh and Ralph.

The following technical papers or addresses also formed part of the excellent program: "Graphic Metering," by Manfred L. Johnson, the Bristol Company, Waterbury, Conn.; "Timing in Watt-hour Meter Calibration," by F. L. Pavey, Duncan Electric Manufacturing Company, Fort Wayne, Ind.; "Instrument Jewels and Pivots," by B. W. St. Clair, General Electric Company, Lynn, Mass.; "Reactive Metering," two papers, by J. M. Joy, test engineer Connecticut Light & Power Company, Waterbury, Conn., and Henry J. Blakeslee, treasurer States Company, Hartford, Conn.; "Organization and Management of a Meter Department," by R. D. Webster, Manchester (Conn.) Electric Company, and "Installation and Maintenance of Relays for Line Protection," by Frank C. Whiting, superintendent Connecticut Power Company, Canaan, Conn.

The value of courtesy as an attribute of metermen in view of their close contact with the consuming public was emphasized in an address by Samuel Ferguson, vice-president Hartford Electric Light Company, and this, with the importance of greater familiarity with rate schedules, was stressed in a talk by C. L. Campbell, treasurer Connecticut Light & Power Company, Waterbury. During the week of the course those in attendance were welcomed at a meeting of the Yale branch of the American Institute of Electrical Engineers, at which M. H. Aylesworth, executive manager National Electric Light Association, gave an inspiring talk upon "Customer Ownership." The course was directed by Prof. A. E. Knowlton of the Sheffield Scientific School, who is also electrical engineer of the Connecticut Public Utilities Commission.

Information Committee Formed at Southwestern Convention

THE Southwestern Electrical and Gas Association and the Southwestern Geographic Division of the National Electric Light Association held a joint convention in San Antonio, Tex., on May 3, 4, 5 and 6. Both conventions were well attended.

At the concluding business session of the Southwestern Electrical and Gas Association on Saturday R. J. Irvine of the Jacksonville (Tex.) Electric & Ice Company was elected president, succeeding C. E. Calder of the Dallas Power & Light Company. Other officers elected are: J. H. Gill, Dallas Power & Light Company, first vice-president and chairman of the power and light section; Alves Dixon, El Paso Electric Railway, second vice-president and chairman of the railway section; P. E. Nichols, Galveston Electric Company, third vice-president and chairman of the gas section; E. N. Willis, Dallas, re-elected secretary; F. G. Ganno, Fort Worth, treasurer.

Officers elected by the Southwestern Geographic Division of the National Electric Light Association are: R. J. Irvine, Jacksonville Electric & Ice Company, president, succeeding A. Hardgrave of Dallas; John W. Carpenter, Texas Power & Light Company, Dallas, vice-president for Texas; J. W. Owens, Oklahoma Gas & Electric Company, Oklahoma City, vice-president for Oklahoma; S. E. Dillon of the Citizens Electric Company, Hot Springs, Ark., vice-president for Arkansas; W. E. Clements, New Orleans Railway & Light Company, vice-president for Louisiana; E. S. Meyers, Vicksburg (Miss.) Light & Traction Company, vice-president for Mississippi.

One of the most important steps taken during the convention of the Southwestern Division was the creation of the Public Utility Information Bureau for Texas, which will be established in Dallas. George McQuaid, veteran newspaper man of Texas and Oklahoma, will be in charge of the bureau.

Massachusetts Issues Tentative Lighting Code for Industries

A TENTATIVE industrial lighting code has been issued by the Department of Labor and Industries of Massachusetts, with the object of permitting its experimental application by employers before a mandatory code is adopted. A public hearing on the code will be held at the State House in Boston on May 16, after which its definitive form will be determined.

The code in its tentative form contains nine rules, ranging from those of general requirements to classifications. A table giving the minimum amount of illumination to be maintained is published. The proper illumination for the various parts of a plant and various kinds of work is prescribed; methods of reducing glare are explained, and rules for the distribution of light to avoid sharp contrasts of intensity are given. Entrance and exit illumination, care of switches, maintenance of lighting fixtures and the use of shades or diffusive glass are other points covered.

San Francisco Awards Contracts for Hetch Hetchy Power Units

THE San Francisco Board of Public Works on April 28 awarded contracts for the equipment to be used in the Moccasin Creek power plant of the Hetch Hetchy water-supply project. It is the present intention to sell power from this plant to one of the large power companies. Deliveries on the units for which contracts have just been awarded are limited by agreement to the period between April 15, 1923, and Aug. 1, 1923.

Contracts awarded were as follows: Pelton Water Wheel Company, four 25,000-hp. double-overhung impulse units, $248,000; General Electric Company, four 20,000-kva. generators with exciters and one spare exciter set, $260,285; Coffin Valve Company, eight 36-in. valves, $37,586. The electrical units involve a departure from standard practice in that they have direct-connected overhung exciters.

Pacific Coast Jobbers Discuss Proposed California Power Act

EFFECTIVE means for defeating the passage of the proposed California water and power act, whereby the water and electric utilities would be subject to state ownership, was the topic for discussion at the spring meeting at Del Monte, Cal., of the Pacific Coast Division of the Electric Supply Jobbers' Association. S. M. Kennedy, vice-president of the Southern California Edison Company, in analyzing the act, predicted some of the results which would follow should a supergovernment of five men be set up in California and receive unlimited authority in the spending of the $500,000,000 which the act would place at their disposal.

Mr. Kennedy characterized the act as the most vicious piece of legislation that had ever been placed on a ballot in this country. He pointed out that the addition of this amount of bonds to the bonded indebtedness of the state would make the total equal to 45 per cent of the total indebtedness of all the states. As the proposed act is claimed to have been modeled after the Ontario plan, Mr. Kennedy visited Ontario to study the conditions there and reported that, after ten years' trial, the Ontario plan was now far from successful. He laid stress on the reported statements of high government officials of Ontario casting doubt upon the financial conditions under which the Ontario Hydro-Electric Power Commission is operating.

A general feeling was voiced at the association's meeting that the electrical market on the Pacific Coast is in a very healthy condition and that the continued expansion of all industries and the great activity in general building will result in a large volume of business during the year.

Industrial Lighting Code Proposed in State of Washington

AN INDUSTRIAL lighting code for the State of Washington is now being drafted by a committee of electrical workers, electrical contractors and the safety division of the State Department of Labor and Industries. When perfected the code will be submitted to the Department of Safety and a public hearing will be held. At present the inspectors can only recommend the installation of proper lighting equipment. The plan is not to add expense by forcing employers to install new lighting fixtures, but rather to provide a standard for future installations. The code will embrace not only yard and factory lighting but also the proper arrangement of skylights and windows. Day Morgan, electrical engineer, who has had experience in drafting lighting codes in other states, has been engaged to gather data and draft the code with the assistance of Mr. Meechem, electrical contractor of Seattle; F. G. Heller of the electrical workers and J. H. Lewis, electrical inspector for the Department of Labor and Industries.

Dr. Aston Tells of Advances in Atomic Structure Study

THROUGH the discovery of isotopes much new light is shed on the structure of the atoms. A series of lectures on this phase of pure electrical and chemical science has just been completed under the auspices of the Franklin Institute by Dr. Francis Aston before various universities and engineering bodies. Dr. Aston is a member of the Cavendish Physical Laboratory, Cambridge, England, which, under the direction of Prof. J. J. Thompson, has long been the leader in research in this field which lies at the foundation of engineering.

Isotopes, as disclosed by Dr. Aston, are substances having identical chemical properties but different atomic weights. They occur in pairs, threes or even larger groups. For a long time the atomic weights of some of the elements as determined by different methods or observers have shown variations in value. Lead is a well-known example. The differences are usually approximately one, two or three times the unit of the scale of atomic weights, *i.e.*, the weight of the hydrogen atom. It appears that the chemical properties of the elements are associated with the number and arrangement of the electrons within the atom. The positive nucleus about which the electrons are supposed to revolve has always been shrouded in considerable mystery, as compared with knowledge of the electron. The behavior of the cathode rays, or streams of electrons, is very definite

and has been largely instrumental in leading to present knowledge of the negative product of gaseous ionization and the negative particles from hot metals, the two being identical. On the other hand, the canal rays or streams of positive particles which pass through openings in the cathode have appeared to have a wide range of values of mass and charge, when subjected to the same class of tests as those used in the study of the cathode rays.

Recognizing that the particles probably have differences of both mass and charge, by an ingenious combination of powerful electric and magnetic fields the canal rays have now been shown to be susceptible of division into definite groups, each group corresponding to particles all having the same mass. Moreover, the differences in mass are simple multiples of the mass of the hydrogen atom. The results of the experiments have led to the strong suggestion that the atoms of all elements are made up of outer systems of electrons, as now long recognized, and of positive central nuclei consisting of different numbers of the positive parts of hydrogen atoms or "protons." Isotopes have the same number of outer electrons, corresponding to identical chemical properties, but slightly different numbers of protons in their nuclei, thus accounting for the differences in atomic weights. Electrical balance is maintained by the presence of electrons also in the nucleus.

Education of Rural Customer in Rate Base Topic at Nebraska Convention

EDUCATION of the rural customer so that he will understand why rates for service to outlying districts must exceed those charged in urban sections occupied the most important place on the program of the recent convention of the Nebraska Section of the National Electric Light Association. This is the second time that the section has held its annual convention in conjunction with the State University at Lincoln. Such close harmony was considered by Chancellor Avery in his address of welcome as a good sign.

The report of the rural service committee, F. H. Brooks chairman, considered the condition now existing in the agricultural states where an unreasonable outlay of capital was required without good prospects for a fair return on the investment. In addition to the excessive initial capital expenditure, the report pointed out that the reason for another charge besides the primary rate of urban consumers was the higher per capita costs of maintenance, the extra transformer and line losses and higher taxes. Mr. Brooks considered it very important to inform the consumer what the entire charge would amount to before building the lines. In this way litigation could be reduced to a minimum. The Nebraska operators are agreed that a development of rural lines will hasten the day when the Railway Commission will control all the utilities.

President W. B. Roberts drew attention to the changing attitude of the public toward utilities. He showed that thirty municipal plants in Nebraska in the year 1921 junked their generating equipment and contracted for transmission-line service from large power companies.

At the annual dinner J. E. Davidson argued for wide-open publicity, a broad public relations policy and friendly co-operation between central-station operators and manufacturers. He urged the university students to learn more than the mere technical phases alone of engineering if they hoped to become successful utility managers.

Walter S. Byrne of Omaha gave a practical talk on "Placing the Dollar Mark in the Engineering Course." Professor Condra presented slides showing water-power development in the state and maintained that the ultimate use of the Nebraska River should not be considered from a political but from an engineering standpoint.

In a discussion on inductive interference the necessary steps by power and signal companies to organize a joint committee whose duty it should be to settle controversies if possible without submitting them to the railway commissions or carrying the matter into the courts were debated.

J. E. Harsh, Lincoln Gas & Electric Light Company, was elected president and T. H. Fritts, Central Power Company, Grand Island, vice-president of the section.

Philadelphia to Have Big Electrical Show

WHAT is expected to be the largest electrical show ever held in Philadelphia is scheduled to take place in the Commercial Museum, the largest covered space in the city, during October next under the auspices of the Electric Club of Philadelphia. The available floor space for exhibition purposes will run to about 75,000 sq.ft. The Electric Club plans to set aside about 10,000 sq.ft. of floor space for an educational exhibit, which will include a "home electric," properly lighted, showing the necessary outlets, appliances and fixtures; a correctly illuminated office and show window, and an industrial plant.

Ohio Electric Light Association Adopts Program for Cedar Point

FOR the annual convention of the Ohio Electric Light Association, to be held at Cedar Point, Ohio, on July 11-14, this program was formulated at a recent meeting of the executive committee:

TUESDAY, JULY 11

Afternoon. — Reports of officers; report of transmission and distribution committee, A. M. Wilson.

WEDNESDAY, JULY 12

Morning. — Report of new-business co-operations committee on rural service, including report of special committee on underground construction for farm service and report of executive committee on policies governing such extensions.

Afternoon. — Report of meter committee, S. C. Henton; address (not determined).

THURSDAY, JULY 13

(Joint session with Ohio Electrical Contractor-Dealers' Association)

Subject: "More and Better Business." Addresses from National Jobbers' Association and National Contractor-Dealers' Association.

Afternoon.—Addresses by A. K. Baylor, General Electric Company, and W. L. Goodwin, Society for Electrical Development.

FRIDAY, JULY 14

Morning.—Address (not determined); report of station-operating committee, William Long.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Controlling Interest in Wilmington (N. C.) Company Bought by Northern Capitalists.—A. E. Fitkin & Company, bankers with offices in New York, Chicago and other cities, have purchased a controlling interest in the Tidewater Power Company of Wilmington, N. C., offering besides to purchase the outstanding holdings. The company, which reported for 1921 a net income of $333,000, will be operated by the General Engineering & Management Corporation.

C., M. & St. P. Is Giving Country-Wide Lectures on Its Electrification.—Lectures on the electrification of the mountain divisions of the Chicago, Milwaukee & St. Paul Railway are now being given by members of the mechanical department staff before engineering clubs and at colleges in cities as far east as Maine and Virginia. Twenty-six cities and eighteen states are represented in the schedule, which went into effect on March 16 at Sioux City, Iowa, and will end on May 24 at Lexington, Ky.

Texas A. & M. to Hold Electric Meterman Course.—The five-day course for electric metermen to be held at the Agricultural and Mechanical College of Texas, College Station, Tex., from June 12 to June 16, will be divided into two groups, one covering the fundamental principles, operation and mantenance of direct-current and single-phase alternating-current meters, the other polyphase and maximum-demand meters. The courses are primarily for men having meter experience who wish a better understanding of the theory involved. The college has co-operated with the Southwestern Electrical and Gas Association in arranging this course.

Induction Motors for United States Superdreadnoughts. — The Westinghouse Electric & Manufacturing Company has built for the Navy Department a number of electric motors to propel the superdreadnoughts of the navy. Four motors are required to propel one battleship, one motor being directly coupled to each of the four shafts. Each motor is rated at 16,500 hp. and makes 227 revolutions per minute. They are almost identical in characteristics and appearance with the 22,500-hp. motors, said to be the largest ever built. The motors are designed for the most economical operation at two ship speeds, the battle speed of 23 knots and the cruising speed of 15 knots. This result is obtained by the use of two entirely separate stator and rotor windings in each motor. At the battle speed one set of windings is used, and at the cruising speed the other set is operative. Sixty thousand cubic feet of air per minute is required to conduct away the heat losses developed in operation. This amount of ventilation air for a period of fifty minutes is equal to the weight of the motor.

New York State Merger.—The New York State Gas & Electric Corporation of Ithaca, N. Y., has purchased the stock of the Tompkins County Power Company, the Onid Electric Company and the Standard Light & Power Corporation and will merge these interests with its own.

Carnegie Foundation Building at Washington Soon to Be Begun.—Erection of the building which is to house the National Academy of Sciences and the National Research Council at Washington is, according to a statement by Dr. C. L. Walcott, president of the National Academy, soon to begin, and it is thought that by a year from next fall the structure will be finished. This building, which is to be the gift of the Carnegie Foundation of New York, will face the Lincoln Memorial in Potomac Park. It will be of simple classical style, three stories in height, rising from a broad terrace and having a frontage of 260 ft. The cost will be $1,300,000.

Mayor Shank Out for Municipal Ownership.—Mayor Lew Shank of Indianapolis has come out as an advocate of the municipal purchase of the principal utility companies' properties in that city, naming specifically the Indianapolis Street Railway Company, the Indianapolis Light & Heat and Merchants' Heat & Light companies and the Citizens' Gas Company. He has announced that he will take personal charge of a fight before the next session of the Legislature for the enactment of a constitutional amendment that will permit the city's bonded indebtedness limit to be increased from 2 per cent of the tax valuation to 10 per cent for the specific purpose of bringing about municipal ownership and operation of the utility companies' plants.

Hydro-Electricity and Navigation on the Rhine. — Much interest is being taken by the countries bordering on the Rhine in the question whether the French proposal to erect several power stations and twenty-four locks or dams across that river will interfere with its navigability. The Versailles treaty gives France, or rather Alsace-Lorraine, the right to take water from the Rhine below Basle, Switzerland, for the generation of electricity, to convey it by canals through the Alsatian plains and return it to the river above Strasbourg. Switzerland, which insists on the right of all nations to unrestricted navigation of the Rhine under the Paris treaty of 1814, wishes also to export electrical energy to Alsace and advocates that the river be "regularized" for navigation and not exploited at enormous expense for the production of electricity. Germany, the third party in interest, favors canalization between Basle and Strasbourg.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Coming Conventions.—Among annual conventions of technical associations soon to be held and not previously announced in this column are those of the Pacific Coast Section of the A. I. E. E., at Vancouver, B. C., on Aug. 8-11; the American Association of Engineers, at Salt Lake City on June 5-7; the American Association for the Advancement of Science, at Salt Lake City on June 22-24; the American Society of Civil Engineers, at Portsmouth, N. H., on June 21-22, and the Society for the Promotion of Engineering Education, at the University of Illinois, Urbana, on June 20-23.

Approaching Section Meetings, A. I. E. E.—These Institute section meetings are announced for the coming weeks: Cleveland, May 16, annual dinner meeting; Erie, May 16, "Twelve Months of Electrical Development," by H. Hansen; Fort Wayne, May 18, annual business meeting; Baltimore, May 19, "Application of Electricity to the Steel Industry," by R. B. Gerhardt, Bethlehem Steel Corporation; Atlanta, May 25, "Industrial and Commercial Lighting," by H. R. Spaulding, Cleveland; Utah (Salt Lake City), May 26, "Mine Signaling," by Abner R. Wilson, Utah Apex Mining Company; Vancouver, B. C., June 2, "Electric Power for Irrigation," by C. R. Yuill. The annual meeting of the association is scheduled for May 19 in New York.

Coming Meetings of Electrical and Other Technical Societies

Florida Engineering Society—Daytona, Fla., May 15-16.
N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see issue of April 22, page 797.)
National Electrical Credit Association—Detroit, May 18-19.
Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.
N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.
Electric Power Club—Hot Springs, Va., June 5-7.
Canadian Electrical Association—Ottawa, Ont., June 15-17.
Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.
American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.
Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.
A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.
American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.
National Council of Lighting Fixture Manufacturers—Cleveland, June 28-29.
Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.
International Association of Municipal Electricians—New Bedford, Mass. Aug. 22-25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Discontinuance of Service for Refusal to Pay Bills Sustained.—The Court of Civil Appeals of Texas, in Withers vs. Fort Worth Gas Company, sustained the right of the company to cut off service because of refusal to pay bills, in the absence of any proof of an overcharge and despite the acceptance by the company of payment for a certain month subsequent to the period for which the bills were in dispute. (238 S.W. 324.)*

City Must Provide Light on Bridge Built by Railroad but Maintained by Municipality.—That a city is liable for failure to provide sufficient light on a bridge opened and maintained by it was the finding of the Missouri Supreme Court in Boyd vs. City of Kansas City. The action was brought because of injuries received when an automobile collided with a girder in the center of the roadway of a bridge erected by a railroad company under plans prepared by the city. The court held that the city was liable because it had invited the public to use the bridge for travel without providing sufficient light to make the obstruction visible. (237 S. W. 1,001.)

Reciprocal Rights in Maintenance of Dam Denied.—Failure of an old dam and the decision of the owner not to rebuild it have brought from the Supreme Court of Michigan, in Goodrich vs. Pollock, the dictum that one acquiring a prescriptive right to overflow lands by means of a dam is under no obligation to maintain the dam, and persons holding under independent titles, and building cottages and other improvements with reference to the artificial level of the water, acquired no reciprocal right or easement to have the dam maintained and such lands overflowed, as against the owner of the dam and the owners of the overflowed lands. (187 N. W. 368.)

United States Supreme Court on Including Federal Income Tax in Operating Expenses.—In the course of its decision sustaining the district court's findings in Galveston Electric Company vs. City of Galveston (see ELECTRICAL WORLD, April 29, page 852) and declaring that confiscation had not been established, the United States Supreme Court thus dealt with the federal income tax in its relation to operating expenses: "The remaining item as to which the master and the court differed relates to the income tax. The company assigns as error that the master allowed, but the court disallowed, as a part of the operating expenses for the year ended June 30, 1920, the sum of $16,254 paid by the company during that year for federal income taxes. . . . In calculating whether the 5-cent fare will yield a proper return it is necessary to deduct from gross revenue the expenses and charges, and all taxes which would be payable if a fair return were earned are appropriate deductions. There is no difference in this respect between state and federal taxes or between income taxes and others. But the fact that it is the federal corporate income tax for which deduction is made must be taken into consideration in determining what rate of return shall be deemed fair. For under Section 216 the stockholder does not include in the income on which the normal federal tax is payable dividends received from the corporation. This tax exemption is therefore, in effect, part of the return on the investment."

Good Will and Earning Power Often Worth More than Tangible Property.—From the decision of the United States Supreme Court in Galveston Electric Company vs. City of Galveston (see ELECTRICAL WORLD, April 29, page 852) the following further extract is made: "Nor is there evidence in the record to justify the master's finding that a business brought to successful operation 'should have a going-concern value at least equal to one-third of its physical properties.' Past losses obviously do not tend to prove present values. The fact that a sometime losing business becomes profitable eventually through growth of the community or more efficient management tends to prove merely that the adventure was not wholly misconceived. It is doubtless true, as the master indicated, that a prospective purchaser of the Galveston system would be willing to pay more for it with a record of annual losses overcome than he would if the losses had continued. But would not the property be at least as valuable if the past had presented a record of continuous successes? And shall the base value be deemed less in law if there was no development cost because success was instant and continuous? Or, if the success had been so great that, besides paying an annual return at the rate of 8 per cent, a large surplus had been accumulated, could the city insist that the base value be reduced by the amount of the surplus? In determining the value of a business as between buyer and seller, the good will and earning power due to effective organization are often more important elements than tangible property. Where the public acquires the business compensation must be made for these, at least under some circumstances, and they, like past losses, should be considered in determining whether a rate charged by a public utility is reasonable. . . . Going concern value and development cost, in the sense in which the master used these terms, are not to be included in the base value for the purpose of determining whether a rate is confiscatory."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Permission for Construction of Municipal Power Line Refused.—The Nebraska State Railway Commission refused to the village boards of Maxwell and Brady permission to construct a 13,200-volt electric transmission line paralleling a railway with heavy leads of telegraph, telephone and signal wires for a distance of about 22 miles, it appearing that the proposed line would be about 60 ft. distant from the telegraph and telephone wires of the railway for a distance of 9 miles and 128 ft. from its signal wires for a distance of about 12 miles. The judgment of the commission was that these distances were not great enough to insure safety at all times in the operation of the railway's wires and that inductive interference would result.

Stock Dividends Allowed at Portland, Me.—Seven quarterly dividends aggregating about $250,000 in arrears are to be paid to the extent of $230,000 in preferred stock by the Cumberland County Power & Light Company, Portland, Me., in accordance with a decision handed down recently by the Maine Public Utilities Commission. The commission pointed out that it has reasonable ground for belief that the company's net revenue will be sufficient to guarantee the payment of the dividend on the stock to be issued. In its finding the board stated that money earned by a corporation remains the property of the corporation and does not become the property of the stockholders until it is distributed among them by the company, and that the corporation may treat such money either as profits or as an addition to its capital.

Eight per Cent Return Held Sufficient.—Rate increases instituted by the Mount Victory Electric Light & Power Company in November, 1921, have been declared to be excessive and unreasonable by the Ohio Public Utilities Commission. The company was instructed to file a new schedule providing a return of 8 per cent on the valuation of its property, as fixed by the utilities commission, and to refund to its patrons the difference between the new and the old schedules for all payments since Nov. 1, 1921. The company has been charging 13 cents for the first 100 kw.-hr. and 12 cents for all over 100 kw.-hr., subject to a discount of 1 cent per kilowatt-hour if the bill was paid before the tenth of each month. The rates ordered by the commission provide 11 cents for the first 50 kw.-hr. and 7 cents for each additional kilowatt-hour. The Mount Victory company purchases energy from the Hardin-Wyandot Lighting Company of Kenton.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

E. A. Robert has recently been elected president of the Quebec Railway Light, Heat & Power Company, in addition to his other numerous executive activities. Mr. Robert first attracted public attention about sixteen years ago when he undertook to enter the power field in Montreal by developing the water power of the Beauharnois Canal and distributing energy in the territory of Montreal. Mr. Robert was born in 1865

E. A. ROBERT

at Beauharnois, Quebec. About ten years ago he became interested in the tramway and power situation of Halifax, N. S., and in 1917 formed the Nova Scotia Tramways & Power Company, Ltd., operating the tramway, light, power and gas services in Halifax and the adjoining city of Dartmouth. He resigned from the presidency of this company in 1919 in order to devote his entire time and attention to the more important tramway and power situation in Montreal and throughout the Province of Quebec. Mr. Robert is also president of the Montreal Tramways & Power Company, Montreal Tramways Company, Canadian Light & Power Company, Montreal Public Service Corporation, Beauharnois Light, Heat & Power Company, Imperial Trust Company, and Quebec Railway Light & Power Company. He is a member of the leading clubs in Montreal and Quebec and sat for two parliaments in the Provincial Legislature.

Iner Carlson has been appointed commercial manager of the Houghton County Electric Light Company, Houghton, Mich. Mr. Carlson was formerly commercial manager of the Keokuk Electric Company, another Stone & Webster property.

Louis A. Keen, manager of the Middletown division of the Connecticut Power Company, has been transferred to the Ponce (Porto Rico) Electric Company.

R. W. Shoemaker has been appointed electrical engineer for the Turlock Irrigation District and will make his headquarters at Turlock, Cal. Mr. Shoemaker was born in Germantown, Pa., in 1881 and was graduated from the California Institute of Technology in 1903. Upon graduation he became connected with the Federal Lead Company of Flat River, Mo., as electrical and mechanical engineer. In 1911 he built the first trackless trolley in America, at which time he was electrical engineer for the Lone Pine Utilities Company. From 1915 to 1920 he was connected with the Great Western Power Company, first as superintendent of the meter department and later as engineer of distribution. During the war he served as lieutenant in the navy and was assigned as instructor in electrical and steam engineering at the San Pedro training camp and engineer officer of the U. S. S. Gwin. Following the war Mr. Shoemaker spent two years in China and Manchuria on investigations for electrical developments in those countries. As electrical engineer for the Turlock Irrigation District he will have supervision of the development of plants with a total rating of approximately 50,000 kw.

Frederick Krug has been appointed superintendent of the La Plaza Hidroelectric plant of the Porto Rico Railway, Light & Power Company and expects to sail from New York about April 1 to take up the duties of the position. Mr. Krug was born in 1894. He was graduated from Cooper Union, New York, in electrical engineering in 1915 and subsequently attended the New Mexico State School of Mines. Upon graduation he was employed by the Watson-Flagg Engineering Company and later as a rotor and stator winder by the Crocker-Wheeler Company. In 1917 he was appointed assistant superintendent of the electrical department of the New York & Honduras Rosario Mining Company in Honduras, Central America. resigning in 1918 to become an instructor in electrical engineering in the Carnegie Institute of Technology. In December, 1918, he became sales service engineer for the Crocker-Wheeler Company ir charge of all repair work handled by the factory through the sales department, from which position he was promoted to be superintendent of the electrical department of that company in July, 1919. Mr. Krug was appointed assistant superintendent of the electrical department of the New York & Honduras Rosario Mining Company in March, 1920, and resigned this position to take up his present work with the Porto Rico Railway, Light & Power Company. Mr. Krug has written numerous articles for the technical press.

William C. Sterne, who was elected chairman of the Rocky Mountain Committee on Public Utility Information to succeed T. O. Kennedy, has had a varied industrial career along with his activities in the operation of public utilities. After graduation from Harvard University in 1891 he spent some time in Europe in the interest of a fertilizer company. Later he moved to Colorado, where he engaged in the drug and

W. C. STERNE

chemical manufacturing business. In 1905 he started a central-station company which is now known as the Summit County Power Company. Later, under the firm name of the Municipal Properties Investing Company, he assumed control of the Arvada Electric Company, the Arapahoe County Electric Light & Power Company, the McCook Electric Company and the Fort Lupton Light & Power Company. In addition to these interests he is president of the Littleton Lumber Company and is a director of the Hamilton National Bank of Denver.

E. G. Allen, formerly engineer of the Westinghouse Electric & Manufacturing Company at South Philadelphia, has joined the engineering department of the Philadelphia Electric Company.

W. H. Garrett has been appointed general manager of the Terrell plant of the Texas Power & Light Company to fill the vacancy caused by the resignation of Kenneth E. Mason.

John R. Proctor, a consulting engineer of Bayonne, N. J., has been awarded the contract for the electric work at the Claremont freight terminal of the Lehigh Valley Railroad, Jersey City, N. J.

J. J. Gibson, who has been manager of the supply sales department of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of assistant to Vice-president H. D. Schute. Mr. Gibson was born in York, Pa., and was graduated from Lehigh University in 1895 with the degree of electrical engineer. He then entered the employ of the Westinghouse company at its old Garrison Alley plant,

J. J. GIBSON

Pittsburgh, where he remained until the following year, when he left to join the American Telephone & Telegraph Company, with which he remained until 1900. In 1900 he re-entered the employ of the Westinghouse company in its Chicago office, where he remained until 1905, being then transferred to Philadelphia. He was appointed district manager of the Philadelphia district in 1906, and in 1914 he was promoted to the managership of the supply department.

D. B. Rushmore, who has been engineer, power and mining department, General Electric Company, at Schenectady, has just been appointed a consulting engineer for the company in order that he may give his time more completely to the general engineering problems in which he is interested.

K. A. Pauly has been appointed engineer, power and mining department, General Electric Company, with headquarters at Schenectady, to succeed D. B. Rushmore, now one of the company's consulting engineers.

E. W. Knight, assistant manager of the fan-motor section, supply department, Westinghouse Electric & Manufacturing Company, has been appointed acting manager of that section, to succeed W. J. Jockers, who resigned recently to go with the St. Paul Electric Company.

Richard Waller has been placed in charge of the Paris office of the American Insulating Machinery Company, Philadelphia, and will handle all Continental European business with the exception of that of Scandinavia.

Daniel D. Gibson, Jr., has recently become connected with the Sanderson & Porter Corporation as electrical designer on extensions to the Windsor Power Station, Power, W. Va. Previous to going to Power Mr. Gibson was connected with the New York Edison Company.

N. Harwood Lasher of Gloversville, N. Y., has recently been appointed manager of the statistical department of the General Electric Company at Schenectady.

E. P. Parker, formerly manager of the Eureka Vacuum Cleaner Company's Springfield (Mass.) office, has been appointed manager of the company's office at Hartford, Conn.

W. J. Jockers has resigned as manager of the fan-motor section, supply department, Westinghouse Electric & Manufacturing Company, in order to accept the position of sales manager of the St. Paul Electric Company, St. Paul, Minn.

Frank P. Cox, who was recently appointed manager of the West Lynn (Mass.) Works of the General Electric Company, is widely known in the field of meter and instrument engineering as a technically trained executive of long experience. Mr. Cox is a native of Terre Haute, Ind., and was graduated in 1887 in electrical engineering from the Rose Polytechnic Institute. He took a post-graduate course of one year at Johns Hopkins University, Baltimore, Md., and soon afterward entered the employ of the Kester Motor Company at Terre Haute. About 1890 he went to Lynn to enter the service of the Thomson Electric Welding Company and shortly afterward took up the work of meter manufacture in the Thomson-Houston plant in West Lynn. For thirty-two years Mr. Cox has been closely associated with the development of meter production and for the last two years he has been manager of the company's Federal Street works in Lynn.

F. P. COX

He has maintained close contact with employees for many years and is highly regarded in his relations with subordinates besides having a high reputation as an expert outside the confines of his own company.

George H. Southard has been appointed president of the J. & B. Manufacturing Company, manufacturer of electrical and ignition specialties, Pittsfield, Mass., to succeed Edward B. Jacobson, who resigned recently. Mr. Southard has been treasurer of the company for the last six years. He was born at Newburgh, N. Y., in 1871 and secured his technical education at the Brooklyn Polytechnic Institute and

G. H. SOUTHARD

Sheffield Scientific School of Yale University, being graduated from the latter institution in 1895. Prior to becoming connected with the J. & B. Manufacturing Company he was in charge of the New York office of the Franklin Trust Company, now the Bank of America. In addition to holding the position of treasurer Mr. Southard has acted as general manager of the organization, and under his guidance the business has grown from a comparatively small beginning to the point where it employs several hundred people. He is a member of the Society of Automotive Engineers.

Obituary

Clifton Wharton, one of the firm of Wharton Brothers, which originally owned the plant that has become the National Works of the National Tube Company, died at his home in Plainfield, N. J., on April 15.

Thomas Flanagan, for twenty years connected with the Western Electric Company, died recently from pneumonia at his home in New York City at the age of fifty-nine years.

Irving J. Bent, superintendent of motive power, electrical department, Illinois Steel Company, South Chicago, Ill., died recently after a short illness. Mr. Bent was born in Needham, Mass., in 1867. He was connected with the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company before joining the Illinois Steel Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Mills Report Second Quarter Production of Electric Sheet Already Booked

INQUIRIES for electric sheet, according to several producers, are meeting with refusals to book the orders for second-quarter delivery, and as the books for the third quarter will not be open for a short time these inquiries are going begging. This condition is due to the fact that producers have had their entire tonnage of sheet for the second quarter booked for the last two weeks. It is true, however, that the mills are not operating at rated capacity by any means, an estimate placing operations at between 70 per cent and 80 per cent. It must be remembered also that black and galvanized sheet, and auto body sheet especially, have been very active and have engaged the capacity of the mills to a large extent. Discounting both of these considerations, producers declare their orders for electric sheet to have been heavier in the last two months than at any time in the last twelve. This is an important sign of activity in the motor, transformer and generator field and backs up the brighter reports coming from manufacturers of this apparatus.

Electric sheet quotations have not followed those on black and galvanized sheets, which were advanced $3 per ton recently, while electric sheet remained firm but did not increase. The base is $4.25 on the United States Steel electric sheets and $3.75 on the armature sheets.

Inquiries at present are not heavy, consumers being fairly well supplied for second-quarter requirements and not wishing to strengthen the market any further by coming in before the books for the third quarter are opened. One large producer stated to the ELECTRICAL WORLD that when third-quarter bookings were available it was highly possible that his sales force would still have to do quite a bit of selling.

Producers Raise Pole Prices for Second Time in Three Months

PRODUCERS of Western red-cedar poles on May 3 advanced the prices of all sizes of their poles, the advances ranging from 50 cents to $1.75 per pole. The new prices per pole in l.c.l. lots, f.o.b. New York, are as follows: 25-ft., 6-in.-top. $5.17; 30-ft., 6-in.-top. $7.05; 35-ft., 6-in.-top, $10.90; 40-ft., 7-in.-top, $15.10; 40-ft., 8-in.-top, $16.45; 45-ft., 8-in.-top, $19.70; 50-ft., 8-in.-top, $22.40. These prices are advances of 50 cents on the 25-ft. pole, 75 cents on the 30-ft., $1.50 on the 35-ft., $1 on the 40-ft., $1.50 on the 45-ft., and $1.75 on the 50-ft. The percentage of increase averages around 10.

This is the second time in a little less than three months that producers have shown their confidence in the market by jacking up prices. The first time was about the middle of March and was confined to only a few sizes. In view of later developments it would seem that the first increase was in the nature of an attempt to feel out the market on the question of a general raise. Previous to March prices had been descending for over a year. This current increase, it is pointed out, is a definite sign that the market is again on the up grade and that the producers, as opposed to the small broker or selling agency, are once more in control of the situation.

Demand in practically all sections of the country is good, with some parts, such as the Southwest, particularly active. Stocks are good, though not too heavy, and producers are not having any trouble in making shipments.

An increase is also announced on Northern white-cedar poles, the 30-ft., 7-in. top pole now selling at $9.40 f.o.b. Chicago.

Building Contracts Let During April Break All Previous Records

THE month of April broke all previous records for the amount of construction started, according to figures supplied by the F. W. Dodge Company. Contracts awarded in the twenty-seven Northeastern states of the country amounted to $353,192,000. The previous high record was for the month of July, 1919, the total for that month having been $317,698,000. April's figures represented an increase of 20 per cent over the previous month and of 60 per cent over April, 1921. The first four months of this year have rolled up a total figure that is just under a billion dollars and is 65 per cent greater than the total for the first four months of last year.

There was an increase in every important class of construction project during the month, even in industrial plants, the last group to show signs of activity. Residential building continues in the lead, amounting in April to $132,478,000, or 37 per cent of the total; public works and utilities amounted to $75,251,000, or 21 per cent; business building to $58,711,000, or 17 per cent, this being a notable increase over last month; educational buildings to $36,718,000, or 10 per cent, and industrial buildings to $24,312,000, or 7 per cent. Contemplated new work reported during the month amounted to $490,926,000.

Metal Market Situation

THE reverse of the usual order of things has taken place in the copper market in the last week, outside selling agencies having taken the initiative in advancing prices while the producers trailed behind. The advance amounted to ¼ cent, bringing the quotation on electrolytic to 13⅛ cents per pound for May, June and July delivery. Most of the producers have come up to this price, though at the beginning of this week especially attractive orders could be placed at 13 cents with a few producers. The Copper Export Association also has advanced its prices to 13⅛ cents c.i.f. European ports. Shipments abroad have been very heavy recently. Domestic buying continues fair, mainly for shipment this month and next.

NEW YORK METAL MARKET PRICES

Copper:	May 2, 1922	May 9, 1921
London, standard spot	£ s. d. 60 2 6	£ s. d. 60 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00 –13.25
Electrolytic	12.87½	13.00
Casting	12.50	12.62½
Wire base	14.12½–14.37½	14.62 –14.87½
Lead, Am. S. & R. price	5.25	5.25
Antimony	5.37½	5.37½– 5.50
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.35	5.40
Tin, straits	31.25	30.62½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00 –11.12½	11.00 –11.25
Brass, heavy	5.25 – 5.50	5.25 – 5.50
Brass, light	4.87½– 5.12½	4.87½– 5.12½
Lead, heavy	4.50 – 4.62½	4.50 – 4.62½
Zinc, old scrap	2.50 – 3.00	2.75 – 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A DEFINITE improvement is to be noted in the electrical industry since the middle of April. Before that time the demand for wiring materials and radio was carrying the burden of trade on its shoulders, whereas now there is a healthy demand for line material, generating equipment, appliances and several other items, while the trend throughout the whole line is upward. Jobbers are well satisfied with their volume, which exceeds anything in the last year. An order calling for twenty-five carloads of rigid conduit was placed with a New York jobber last week and, although not an average order, it shows how building construction is stimulating jobbing trade. Production of large apparatus in the New England centers is reported to be increasing rapidly, though it still is below normal. Continued improvement is seen in Southeastern jobbers' business, and prices are stiffening there. The same chain of occurrences is found to be taking place in Chicago and St. Louis. Good range business is being reported by all sections of the Pacific Coast, the wide sales campaigns on a time-payment basis bearing fruit at last.

NEW YORK

Improvement of conditions in the electrical trade has been going ahead steadily for the past two months, and it now appears that better times are here to stay. The best indication that business is on the up grade is the actual increase in volume of sales. One jobber reports that his April sales were the largest in any month during the past two years. This business is not confined to any particular class of material, but is well distributed over the entire line. A large potential market is developing with the increased building activity, and the effects of this are already being felt in the number of inquiries that are being received. During the past week an order for twenty-five carloads of conduit to be used on one job was placed by a contractor. This is probably the largest single sale of wiring material made in this section since 1920.

Generally there is a better tone to the whole market, and while there is little indication of immediately increasing prices, those now in effect are much steadier. Jobbers' stocks are fair to good and no shortages are reported. However, it is believed that most contractors' and dealers' stocks are pretty low because of the hand-to-mouth buying of the last year. All of these factors point to very satisfactory conditions in the electrical trade for the rest of the year.

Conduit.—Sales have been very good for the past week as it seems that present quotations have been very attractive to contractors and dealers. Jobbers who had fair stocks on hand or ordered before the last advance have given their customers the benefit of the old price. It is doubtful, however, if conduit can be bought at the former price by the end of this week. Quotations ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Demand is fairly active and prices show no change. In 5,000-ft. lots No. 14, rubber-covered, sells for $6.25 per 1,000 ft. In lots of 10,000 ft. and over quotations have been made around $6.15 per 1,000 ft.

Flexible Armored Conductor.—Sales are steady and demand holds up well. No. 14, two-wire, single-strip, sells for $43 to $45 per 1,000 ft., and double-strip is quoted at $45 to $47 per 1,000 ft. Most sales are being made at the lower figure. Stocks are only fair.

Lock Nuts and Bushings.—Quotations on lock nuts and bushings have been advanced about 10 per cent. These items, which formerly were quoted at 70 and 10 per cent off list, are now quoted at 70 per cent off.

B-X Connectors.—Prices have dropped about 7½ per cent through an increase in the discount from 35 per cent to 40 per cent.

Sockets.—Demand is good and prices have remained unchanged. Pull sockets in standard-package lots of 250 are quoted at $33 per 100. Key sockets in standard-package lots of 500 sell for $18.15 per 100, and keyless in the same quantity are quoted at $16.50 per 100.

CHICAGO

Several price changes occurred this week along with the sustained and improving demand for wiring materials. Jobbers are beginning to feel the result of the several thousand building permits issued during March and April. Flexible armored conductor increased in price about 5 per cent, and dealers attribute it to the uncertainty caused by the coal strike. An increase of $1 was announced on several standard-sized red and white cedar poles. Pole-line hardware also was increased about 10 to 15 per cent. The motor industry is returning to normal and the small-motor field is improving.

Building permits for April virtually equaled the number issued in March. Permits for 1,315 buildings call for an expenditure of $17,076,560 with a frontage of 38,077 ft. The gain over the same period last year is 782 buildings with 22,250 more feet of frontage, but with an increased valuation of only $1,977,660.

Flexible Armored Conductor.—An increase in price was noted this week. In 5,000-ft. lots the No. 14 double-wire, single-strip varies from $44 to $45 per 1,000 ft. Dealers tell of a very active demand for this material. Stocks are ample.

Conduit.—A healthy movement in pipe was reported by most dealers. Prices range from $42 to $43 per 1,000 ft. for the ½-in. black pipe in 5,000-ft. lots. Stocks are good.

Wire.—The activity in the building line is carrying this material along so that the demand on most dealers is good. However, keen price competition still exists, and prices vary from $6 to $6.25 per 1,000 ft. for the rubber-covered No. 14 in 5,000-ft. lots. Most dealers' stocks are good. The movement of bare and weatherproof wire has been steady.

Motors.—Nearly all manufacturers report improvement in the demand. Conditions in the small-motor market are gradually becoming easier. One manufacturer reports a much better call for both large and fractional-horsepower motors, but says that these are fairly well distributed instead of being grouped entirely within one industry.

Transformers.—The spring expansion and replacement work of utility companies has resulted in a better call for distribution transformers, but, according to manufacturers, the volume consists of a number of small orders rather than a few large ones.

Fans.—A few dealers report that the movement of fans has started, but the cool weather during April has delayed sales. However, jobbers are shipping stocks to dealers on regular schedule.

Poles.—An increase in price on both the Northern white cedar and the Western red cedar was announced this week. This makes the 7-in. top, 30-ft. Northern white-cedar pole sell for $9.40 f.o.b. Chicago. An increase of $1 was also made on the 5½-in. to 8-in. top, 30 ft. size. The Western red cedar in the 7-in. top, 30-ft. size is quoted at $8.30 f.o.b. Chicago, an increase of $1. The call for poles is very active.

BOSTON

A stronger tone is apparent in trade, with improved movement of wiring supplies and a slightly better demand for motors. General business in New England is gaining, despite the protracted strike in the cotton textile industry. Woolen mills are busy, paper manufacturers are active, and makers of rubber goods and automobile accessories are busier than awhile back. Building operations are growing rapidly into totals that are affecting the electrical trade, and house-wiring campaigns are meeting with notable success. While residential building predominates, some important mercantile structures are under way, and it was announced last week that financing has been arranged for a new five-million-dollar building for the Boston Chamber of Commerce to be erected in the financial district. So far the coal strike has had little noticeable effect on business in this territory. Central-station outputs are gaining in many quarters, and the electrical demands of the Boston Edison territory are picking up gradually. New life has begun to show itself in Boston marine circles, through use of facilities for shipments to the Pacific Coast via the Panama Canal. The production of larger units of electrical apparatus, especially for Asiatic trade, is increasing.

Radio Apparatus.—No let-up in demand is evident. Ninety exhibitors kept open house at last week's radio show in Boston, the attendance being 30,000, notwithstanding three rainy days. Shortages in vacuum tubes and telephone receivers continue. Scheduled production in one establishment making tubes has increased from 75,000 in February to 150,000 in May, and another company's New England factory is producing 500 complete receiving sets daily with plans to double this output by midsummer. Deliveries are improving on aërial insulators, these being obtainable on a two weeks' basis at present. Magnet-wire deliveries for radio work are uneven.

Motors.—Slow but steady recovery in demand is evident. Motors under 10-hp. rating are in chief request. One distributer reports a decided gain in sales last week, and on the whole conditions look better than for some time.

Ranges.—Inquiries are in better volume in retail circles, and the outlook continues good for a healthy season. Competition is sharp for the business offered.

Transformers.—The demand for large units is much improved, especially for Far Eastern trade. Hydro-electric development in Japan is increasing, and this is reflected in New England transformer production. Distribution types are also moving somewhat faster. Prices are firm.

Meters.—Trade is fairly good, owing to new building operations. Excellent deliveries and steady prices rule.

Refrigerating Equipment.—Popular interest in electrical ice making is increasing, and one retailer has sold about ten installations within the fortnight. Prices are favorably regarded by the consumer, it is reported.

Wire.—Competition is sharp for existing trade in rubber-covered and weatherproof wire. The former, No. 14, sells from $6 to $6.25 per 1,000 ft. in 5,000-ft. lots, the market being wide open above this. The large number of interior wiring jobs is creating fairly good business in rubber-covered wire.

ATLANTA

"Unmistakable evidence of continued improvement in business conditions" is the opening line of the business review by the Sixth Federal Reserve Bank for April. While inclement weather is interfering materially with agricultural activities, an increase in the price of nearly all farm products has resulted in a considerably improved outlook among the farmers, with a consequent reflection of better business in the small towns. Preliminary reports on the prospective cotton crop, together with a stronger demand for the staple, have sent cotton prices back to an attractive figure, Atlanta spots being quoted at 18.35 cents. Cotton held in the district but which will now be released will serve to liquidate quite a large amount of outstanding accounts.

Reports in general indicate a decrease in the number of unemployed, due to increased building activities, municipal improvements and the employment of labor on farms. Building permits for Atlanta in the month of April reached a total of $1,297,000, an increase of more than half a million dollars over April, 1921. The number of permits amounted to 503, as against 324 for April, 1921.

Electrical jobbers report a general improvement in their lines. There is some tendency toward price advancing which seems to be stimulating purchases by the small contractors. A number of the larger electrical retailers are preparing to undertake sales campaigns for household appliances, effective this month, and the general opinion is that electrical appliances and heating devices will show greater activity very shortly.

Industrial Motors.—Business is on the up-grade, one of the largest distributers reporting very satisfactory sales, particularly in sizes up to 40 hp. with the three-phase, 220-volt types most in demand.

Panelboards.—Sales are very satisfactory, particularly on the sectional type, the tendency apparently being to make a more liberal use of this specialty than has been the case heretofore. Factory shipmnts are good and prices steady.

Poles.—No marked change in the situation is reported, purchases still being rather slow, with good stocks at all yards. Creosoted poles show a slight reduction in price, but chestnut prices are steady.

Pole-Line Hardware.—A fair movement is reported, particularly in the class of material used for rural telephone extensions. A price advance of 10 per cent seems to have stimulated sales and stocks are reported quite satisfactory.

Portable Drills.—A slight improvement in this line is to be noted, though sales continue rather small owing to the failure of automobile and garage business to get back on a stable basis. Local stocks are good to heavy with prices steady.

Lightning Arresters.—Anticipation of the summer months is causing quite a satisfactory turnover in this line, with the compression type leading in demand. Local jobbers have accumulated very satisfactory stocks for seasonal sales and expect no reduction in price.

ST. LOUIS

The more extensive scale upon which building operations are being conducted is shown in the April report of building permits for St. Louis, the amount being $2,111,596. as compared with the March figure of $1,799,005 and the April, 1921, value of $1,127,155. The permits issued during the first four months of this year amounted to more than double those for the same period of last year, the respective values being $6,315,866 and $3,149,430. Most of the construction is for residential purposes, and the permits for factories and workshops make a very small portion of the total. The latter amounted in April to only $34,000, and for the first four months of this year to only $124,460. Most of the industrial work has consisted of improvement of equipment in existing buildings, and no indication of such work would be found in the above figures, for they include only the cost of the buildings.

Jobbers were quite enthusiastic about the business done last week, not that it was of extremely large volume, but it was more active than has been experienced for some time and gave indications of further improvement. A large order for high-voltage underground cable was placed, weatherproof wire was active, poles were moving in increased volume. warm weather began to move fans, and orders for radio equipment continued to pile up. Several jobbers report that the April business was better by a substantial margin than has been experienced for many months. Price increases on poles, pole-line hardware and conduit boxes were noted.

Poles.—With substantial improvement in demand, prices have been increased by $1 to $2 per pole. Resultant quotations for Northern white cedar poles with 7-in. tops, in carload lots, f.o.b. St. Louis, are: 30-ft., $9.90; 35-ft., $16.60; 40-ft., $20.30; 45-ft., $23.75. Stocks are said to be

in good condition and immediate deliveries can be given. A large portion of the buying is for telephone work, but power companies are buying for distribution work, and there is some purchasing for transmission construction.

Cross-Arms.—Increased sales and good stocks are found. Fir arms, 3¼-in. x 4¼-in.. in lots of 1,000 lineal feet and more, f.o.b. St. Louis, are priced per 100: 3-ft., $45.60; 4-ft., $60.90; 6-ft., $91.35; 8-ft., $121.80; 10-ft., $152.25.

Flexible Armored Conductor.—Volume of sales has shown very little variation since the first of the year, and low stocks are maintained because of the low demand.

Pole-Line Hardware.—Double-arm and cross-arm bolts have increased in price by about 15 per cent and other items by about 10 per cent. Movement has accelerated to some extent in the past ten days, and stocks are reported to be in good condition to meet the increased demand.

Conduit Boxes.—Word is received that prices are increased about 5 per cent, but the new prices on individual items have not been established. The demand is not very active, and stocks are conservatively maintained.

Wire and Cable.—Sales of bare and weatherproof were substantially better last week, and a large order for high-voltage cable was placed, with other large cable orders pending. No. 14 bare stranded is finding a good opening in the radio field and is quoted at 28 cents per pound. The base on weatherproof is 15½ cents per pound, and that on bare from 16 cents to 17 cents per pound. No. 14 rubber-covered continues to move in comparatively good volume at $6.25 to $6.50 per 1,000 ft. in 1,000-ft. lots.

SAN FRANCISCO

California building during April showed an increase, except for a temporary falling off in the extreme Southwest sections. The value of building permits issued during April, 1922, is as follows: Los Angeles, $12,954,288; San Francisco, $3,993,720; Oakland, $1,782,189; San Diego, $1,006,010. Los Angeles has set a new high mark for the Coast in these figures. Elaborate electrical installations for new public schools have resulted in an excellent immediate demand for electrical wiring and apparatus. An increasing number of secondary schools are now being equipped with household appliance departments. When the range campaign is finally inaugurated it will prove a stimulus to retail-store buying, which even now is better.

Conduit.—Fluctuations of price have brought a corresponding activity in purchase orders from dealers, though these have not caused any appreciable shortages except in one or two galvanized types. The present prices for galvanized styles run generally about $6 per 100 ft. for the ½-in., $7.80 per 100 ft. for ¾-in. and $11.25 per 100 ft. for 1-in. in any quantity. Black conduit is being quoted generally at about $5.55 per 100 ft. for ½-in. with other sizes at proportionate prices.

Batteries.—There is an extensive demand for wireless-type batteries, but nevertheless few shortages are reported. A seventy-two-cell battery of great amplification is being sold for $9 in lots of ten and a twenty-seven cell, 18-volt to 43-volt battery for $3.

Radio Supplies.—Foreseeing possible duplications of stocks when Eastern and local factories begin to deliver the orders which have been promised for the latter part of May and for June, local dealers are beginning to be very wary in ordering. A desperate situation of shortage caused quite frenzied buying, but the situation is clearing, and within the next month good stocks should be on hand.

Wire.—Weatherproof in three-braid base sizes is now selling in coil lots for $20.50 per 100 lb. The local stock situation is again normal through the arrival of stocks of sizes 4, 6 and 8. Bare copper wire is being quoted on a basis of $18.70 per 100 lb. with progressive additions of 50 cents per 100 lb. in 100-lb. lots to $10 per 100 lb. in less than 24-lb. lots. Bare wire is now brisk in movement, and these graduated additions providing for unusually small quantities are made necessary by the call for radio antennas.

PORTLAND—SEATTLE

Utah coal mine operators have proposed to reduce the price at the mine $1 a ton and the haulage charge to the Puget Sound region by $1.35 a ton, making a total reduction in the price of coal in Seattle of about $2.35 a ton. Conditions in the lumber industry continue to improve. Production for the week ended April 29 was only 3 per cent below the normal, i.e., the aggregate cutting capacity of the mills reporting for an eight-hour day.

Building continues active. April permits in Portland totaled 1,366, with a valuation of $1,865,970. Residence permits numbered 334, with a valuation of $1,248,285, a 25 per cent increase in valuation over April, 1921. Electrical permits to the number of 1,286, with a valuation of $146,035, were issued during April in Portland. This is an increase in valuation over April, 1921, of 69 per cent and is the largest month's business in the history of the department. During the month of April 973 permits having a valuation of $1,632,175 were issued in Seattle, as compared with 1,091 permits. valued at $1,439,855, reported for April, 1921.

Electrical jobbers of Portland report business materially improved over a week ago, while Seattle jobbers state that business is about the same as for several weeks past. There seems to be an ever-increasing tendency toward buying in standard-package quantities. Copper is very low at the present time and demand is good. It is predicted that there will be a raise in price forthcoming soon in steel, copper and rubber. Contractor-dealers are doing a good business in wiring and particularly in fixtures. Portland dealers report store sales normal, not including the heavy demands for radio material. Ranges are in demand in Portland and appliances are picking up.

Conduit.—Demand for conduit is very good. Recent price advances in Seattle have not affected sales. Quotations are: ½-in. black, $5.74 to $6.25; ¾-in. black, $7.11 to $8.05; ½-in. galvanized, $6.03 to $6.80; ¾-in. galvanized, $7.83 to $8.85. All prices are per 100 ft. in 10,000-ft. lots.

Outlet Boxes.—Sales have been stimulated by the educational campaigns put on by contractor-dealers and jobbers to increase the use of convenience outlets. Quotations are: 3-in. boxes, $8.10 to $9.40, and 4-in. boxes, $10.57 to $11.74, per 100 in standard quantities.

SALT LAKE CITY—DENVER

Building activity for April showed a substantial gain over permits for the same month of 1921. The increase was reflected both in the number of buildings begun and the total amount appropriated for construction. May promises to show an even more decided improvement in building and construction. Extensive road projects are getting under way, furnishing labor for hundreds that have been unemployed during the winter and spring. Labor troubles in the coal fields are subsiding, and production is picking up gradually, nearly every important Utah mine operating either part or full time. Metals are getting in better shape, with the market showing steady improvement. There is a resulting increase in the volume of electrical merchandise sold to the mining companies.

Several steel manufacturers have recently announced their intention to manufacture radio poles. They will build them according to any specification. The first "listening-in" demonstration with their new equipment will be made within a week by the Salt Lake City Commercial Club.

Electric Ranges.—Advertising is now focusing attention on electric ranges, with the result that an increased number of sales are being made. Easy-payment plans are being intensively featured.

Motors.—With the approach of the irrigating season interest in motors for private orchard and farm pumping installations is being shown. This is a constantly expanding market. Some recent rulings of public utility commissions have favored extremely moderate power rates, and this, it is believed, will further encourage the use of motors for pumping water to farms and orchards.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Company Organized to Manufacture "Hot Line" Tools

The W. T. Safety Tool Company, Inc., Taylorville, Ill., has been formed to manufacture and distribute tools and equipment for working on high-voltage transmission lines and equipment without interruption of service. The products of the company, according to the announcement of W. D. Williams, secretary-treasurer, form a complete equipment for this sort of work.

The company was formed shortly after the first of the year and now has production in full swing. A selling organization is now being formed, and it is planned to cover the entire country in the near future with road salesmen. Jobbers of high-tension material are also being interested as distributors, and demonstrations are now being given to leading central-station companies and jobbers. The officers of the company are: C. R. Wood, president; M. T. Tipsord, vice-president; W. D. Williams, secretary-treasurer.

Lighting Fixture Manufacturers Meet in Cleveland in June

The midsummer convention of the National Council of Lighting Fixture Manufacturers is to be held in Cleveland June 28-29, according to an announcement sent out by headquarters of the organization. A definite program has not been arranged yet, but it is understood that one of the subjects to be taken up is the introduction of a uniform system of cost accounting among member firms.

Retail Stores May Form Radio Distributing Syndicate

The National Retail Dry Goods Association, it is learned, is obtaining a favorable response from its members in answer to an inquiry on the advisability of forming a syndicate of stores to handle the distribution of radio apparatus. The inquiry was sent out recently, and the report of the retailers' committee appointed to study the radio problem was communicated to the stores at the same time. This report put forward the idea of having the stores pool their purchases and suggested that a company be formed for the purpose which would not be connected directly with the association but tied up to it in some way, possibly in an advisory capacity.

It was found by the committee that the Radio Corporation of America would deal directly with the stores if they pooled their purchases.

The committee explained that the pooling of buying orders would make the manufacturing problem less difficult, thus making possible preferential discounts. The appointment of another committee was suggested to carry out the plan for a company of retailers.

Westinghouse Forms Merchandising Sales Department

A reorganization of the supply sales department and the establishment of a merchandising sales department by the Westinghouse Electric & Manufacturing Company have been announced by H. D. Shute, vice-president. The changes, which entail the promotion and transfer of a number of officers and are considered to be among the most important actions taken by the Westinghouse company in several years, became effective May 1. At that time the new merchandising sales department began to function.

J. J. Gibson, manager of the supply sales department, becomes assistant to vice-president in the new plan of organization. In his new position Mr. Gibson will have supervision over the activities of both the supply sales and the new merchandising sales department. Other changes are as follows:

A. A. Brown is appointed manager of syndicate operations; J. S. Tritle, manager of the St. Louis office, becomes manager of the merchandising sales department; T. J. Pace, assistant manager of the supply department, becomes manager of the supply sales department; C. E. Allen, manager of the central-station division of the Chicago office, becomes manager of the St. Louis office; George Baily, assistant to the manager of the supply department, becomes supervisor of distributing agents; M. C. Morrow, assistant sales manager of the Westinghouse Electric Products Company, becomes assistant to the manager of the merchandising sales department, and J. J. Dorney, manager of the industrial division, St. Louis office, becomes assistant to the manager of the merchandising sales department.

Ilg Company Plans Wide Ventilating-Fan Campaign

An extensive campaign to bring to the attention of the public the value of ventilating fans and to increase the sale of its product has been launched by the Ilg Electric Ventilating Company, Chicago. One of the most important objects of the campaign will be to establish a "Good Health Week" from Oct. 23 to 30.

Hurley Machine Company Betters Financial Position

While the annual report of the Hurley Machine Company, Chicago, washing-machine manufacturer, shows less business done in 1921 than in 1920, it also shows an improved financial position for the company at the end of the year. Net income after payment of all charges and preferred dividends was $429,309 for 1921 against $706,663 for 1920.

The surplus for the year was $29,556 as compared with $175,175 in 1920. For 1921 the net sales were $3,708,261 against $8,967,685 for 1920. However, the year closed with cash in banks and United States certificates totaling $1,268,315 and inventories of $904,458, a reduction of $892,932 as compared with Dec. 31, 1920. During the year bank loans of $977,500 were liquidated in full. The present ratio of current assets to current and accrued liabilities is 5.17 to 1, which compares with a ratio of 2.36 to 1 at the close of 1920. Net sales of electric washing and ironing machines were 42 per cent of the 1920 sales. The 1921 net income was 11½ per cent of the net sales, as compared with 8 per cent in 1920.

The prospects for 1922, according to Edward N. Hurley, chairman of the board, are very encouraging, as indicated by the shipments of orders amounting to $962,793 in the first three months of this year. This compares very favorably with the same period in 1921, when the orders amounted to $777,554, particularly in view of reductions in prices amounting in some instances to as much as 28 per cent.

General Electric Stockholders Authorize New $35,000,000 Issue

Stockholders of the General Electric Company at their annual meeting Tuesday, May 9, at Schenectady, N. Y., voted to increase the authorized capital stock by $35,000,000, consisting of 3,500,000 shares of par value at $10 each. The new shares will be issued without voting or subscription rights, but will be entitled in priority to the common stock to cumulative dividends at the rate of 6 per cent per year.

As explained in a letter sent out previous to the meeting to all stockholders by C. A. Coffin, chairman of the board of directors, these shares will be used to pay 5 per cent annual stock dividends on the common stock, and such payments will take the place of the 2 per cent semi-annual stock dividends heretofore paid in common stock. It is expected that the first of such 5 per cent annual stock dividends will be paid next October.

This dividend plan will eliminate a vast number of fractional shares, as the only fractions will be half shares, the conversion of which into full shares of $10 each can be easily made. Under the proposed plan, stockholders will receive for each two shares of common

stock which they own an annual dividend of one ten-dollar share of the new stock.

The stockholders at this meeting also authorized an amendment to the bylaws of the company whereby the number of directors is to be increased from fifteen to nineteen. The following fifteen directors were elected at the meeting on May 9 for the ensuing year: Gordon Abbott, Boston; Oliver Ames, Boston; George F. Baker, Jr., New York; Anson W. Burchard, New York; C. A. Coffin, New York; George P. Gardner, Boston; Francis L. Higginson, Jr., Boston; D. W. Morrow, New York; Marsden J. Perry, Providence, R. I.; Seward Prosser, New York; E. W. Rice, Jr., Schenectady, N. Y.; B. E. Sunny, Chicago; Robert Treat Paine, 2d, Boston; Philip Stockton, Boston, and E. R. Stettinius, New York.

New York Dodge Office Now in Dodge Building

The Dodge Sales & Engineering Company, Mishawaka, Ind., manufacturer of power-transmission appliances and heavy oil engines, has moved its New York City branch from 21 Murray Street to the new Dodge building, located at the corner of Park Place, West Broadway and Murray Streets and known as 53 Park Place.

The new Dodge building is twelve stories high, of steel and concrete construction and is modern in every detail. Four elevators are installed in the building, and special provision has been made for extra heavy floor loads, which permits of ample provision for the storing of emergency trade service stocks as well as the display of power-transmission machinery and heavy oil engines. The Dodge Manufacturing Company has maintained a branch and warehouse in New York for more than twenty-eight years and in moving to its new building, conveniently located as regards shipping and railway facilities, it will be able to handle more efficiently its local and export business.

Western Electric Makes Record Amount of Cable in March

The telephone cable plant of the Western Electric Company at Hawthorne, near Chicago, broke all its records for production in March. During the thirty days ending the first fiscal quarter it made more wire into lead-covered cable than during any other like period in its existence. There were used 1,789,147,000 ft. of copper wire in the process. The previous largest amount produced in one month was 1,419,829,000 conductor feet in September, 1921, 369,318,000 ft. less than in March. The latter month was also marked by a new record for a weekly output. During the last week of the month the conductor-feet figures reached a total of 410,143,000.

The Hall-Mark Electric Supply Company, jobber of electrical supplies, lighting fixtures and brass goods, has opened an establishment at 625 Broadway, Brooklyn, N. Y.

The Thomaston Manufacturing Company, Thomaston, Conn., has adopted a capacity schedule of operation at its plant, running for the most part on radio sets and parts.

The General Radio Corporation, Philadelphia, is arranging for the operation of a local plant for the manufacture of a full line of wireless equipment. It is proposed to commence work before the close of the month. The company is headed by Walter L. Eckardt, chairman of the retail merchants' committee of the Chamber of Commerce, Twelfth and Walnut Streets.

The Fisher Motor Company, Orillia, Ont., Canada, has started construction work on its new buildings.

The Electric Hoist & Derrick Company, Baltimore, Md., is to handle the sales of the electric hoists and derricks at the Hog Island Shipyard, Philadelphia. William H. Price, Jr., will be in charge of the work at the yard.

The Canada Electric Castings Company, Orillia, Ont., Canada, has started work on its new buildings in that city.

Foreign Trade Notes

FRENCH MACHINERY EXPORTS.—The official French statistics for the year 1921, recently published, show that the exports of electric generators and elecrical apparatus have greatly decreased. Exports of generators in 1919, were valued at 19,873,000 francs; 1920, 41,080,000 francs; 1921, 6,959,000 francs. Exports of electrical apparatus in 1919 were 92,387,000 francs; 1920, 126,263,000 francs; 1921, 27,356,000 francs.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in India (No. 1,721) desires to purchase electrical goods, metals, wire, etc.

The purchase is desired in India (No. 1,754) of a complete electric plant for a farm of about 1,000 acres. Power will be obtained from a hydro-electric station, 5 miles distant from the farm.

A firm of general merchants in India (No. 1,760) desires a manufacturer's sales agency for the sale of electrical goods, electric motors, etc.

An engineering company in India (No. 1,810) desires to represent firms for the sale of induction motors, 50-cycle, single-phase, up to 1½ hp., to operate on 230 volts; three-phase squirrel-cage, from 5 hp. to 15 hp. to operate on 400 volts, with starters; three-phase, slip-ring type, from 15 hp. upward, with necessary control; direct-current motors, shunt or compound, with starters and field resistances, for 110, 230 and 400 volts; small motor-driven, single-stage centrifugal pumping sets, directly connected; electrical supplies and heating appliances for 230-volt service.

A request has been received from a merchant in England (No. 1,812) desiring to purchase or secure an agency for small gasoline engines from 3 hp. to 4 hp., capable of generating electricity for small hotels and country residences.

A municipality in Mexico (No. 1,825) is in the market for electric street lamp standards. Approximately 110 will be required.

A merchant in Switzerland (No. 1858) desires to secure an agency from manufacturers only for the sale of electrical novelties, etc.

ELECTRICAL MACHINERY AND SUPPLIES.—Carr & Haynes, Casilla 2769, Santiago, Chile, electrical contractors and dealers, request manufacturers of electrical machinery, appliances, supplies, fixtures, telephones, etc., to supply them with catalogs, price lists and export discounts.

New Apparatus and Publications

RADIO LIGHTNING PROTECTOR.—Schweitzer & Conrad, 4435 Ravenswood Avenue, Chicago, have issued Bulletin No. 501, describing their new radio lightning protector, consisting of the regular high-voltage S. & C. fuse spark gap and a choke coil. Bulletin No. 501-A describes a radio lightning arrester, a smaller type than the protector, which includes a spark gap and the regular S. & C. use.

BEARINGS.—The Kingsbury Machine Works, Philadelphia, is distributing Catalog "C," describing the "Kingsbury" thrust bearings.

INDEX.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a revised index applying to catalog No. 17, issued in 1921, and bulletins.

GENERATOR FOR RADIO OUTFITS.—A new line of high-voltage, direct-current generators and motor-generator sets for use with wireless telephone outfits has been developed by the Robbins & Meyers Company, Springfield Ohio.

LIGHTING PLANTS.—A small lighting and power plant, rated at 1½ kw., driven by a single-cylinder kerosene engine, has been placed on the market by the S. Wylie Merritt Company, 697 West 133d Street, New York City.

DISHWASHER.—The Bucyrus (Ohio) Copper Kettle Works Company has placed on the market an electric dishwasher, "Murdoch," for use in homes, apartments, diet kitchens and small tea rooms.

BATTERY TESTER.—The J-M-P Manufacturing Company, 172 Seventh Street, Milwaukee, has placed on the market a device for testing batteries at high discharge.

RADIO SET.—A crystal-detector radio receiving set has been placed on the market by the Rex Radios, Inc., 36 Spring Street, Newark, N. J.

TIME-SWITCH CLOCK.—A time-switch clock with an eight-day movement has been developed by the American Time Switch Company, Perkins-Power Block, Frankford, Avenue, Cleveland.

FRACTIONAL-HORSEPOWER MOTORS.—A line of small motors ranging in size from ¼ hp. to ¾ hp. has been brought out by the Leland Electric Company, Dayton, Ohio.

LIGHTING ATTACHMENT.—An atachment for converting vases into portable lamps has been placed on the market by the De-Lite Lamp Company, 80 Boylston Street, Boston.

SOCKETS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing bulletin No. 17-11, covering its electrolier push-button sockets.

INSULATION.—The Fibroc Insulation Company of Valparaiso, Ind., has issued a six-page bulletin which describes its four grades of "Fibroc" insulation.

New Companies

THE MAQUOKETA (IOWA) HYDRO-ELECTRIC COMPANY has been incorporated by A. A. Hurst, W. L. Keck, J. E. Anderson and others. The company is capitalized at $100,000 and proposes to construct a hydro-electric plant.

THE HASKELL (FLA.) LIGHT & POWER COMPANY has been chartered with a capital stock of $15,000. The officers are: James Harris, president; E. Winton Hall, vice-president, and J. L. Gilliam, secretary, all of Lakeland, Fla.

GRAND SALINE (TEX.) LIGHT & POWER COMPANY has been incorporated by T. S. McGrain C. O. and E. L. Dixon. The company is capitalized at $25,000.

THE ELMHURST (PA.) ELECTRIC COMPANY has been organized to furnish lighting and heating service in Elmhurst. The company proposes to secure electricity from the Moscow (Pa.) Electric Company, recently organized. The incorporators are B. J. and Stewart Biesecker, H. C. Finn and C. L. Frantz, Elmhurst; A. M. Sayre, Dr. J. W. Kneedler and F. J. Doherty, Moscow.

THE NAPANOCK (N. Y.) ELECTRIC COMPANY, Inc., has been granted a charter to generate and distribute electricity in Lackawanna, Honk Hill, Montela and Warwarsing. The incorporators are Morris Sutts, Samuel Moll and Jacob Benson, all of Napanock.

Record of Electrical Patents

Notes on United States Patents

(Issued April 18, 1922)

1,412,941. REVERSING SWITCH; Frank Hoffner, Bessemer, Mich. App. filed June 11, 1921. Automatic control of railway motors.

1,412,959. SPECIFIC GRAVITY CONTROL FOR ELECTRIC CIRCUITS; Edward I. Pearson, Toledo, Ohio. App. filed Nov. 10, 1919. Storage-battery charging set automatically controlled by specific gravity of electrolyte.

1,412,972. STARTING MAGNETO; Wolfgang E. Schwarzmann, Springfield, Mass. App. filed Sept. 27, 1918. Hand-operated.

1,412,982. CASING FOR TELEPHONE SETS; John S. Timmons, New York, N. Y. App. filed May 3, 1919. Waterproof, for outdoor use.

1,412,986. PREPARING MANGANESE-CONTAINING BODIES; Alfred A. Wells, Montclair, N. J. App. filed Oct. 27, 1917. Purifying of depolarizer from used dry batteries.

1,413,001. CONSTRUCTION OF CURRENT-CARRYING RESISTORS; Wallace L. Brooks, Schenectady, N. Y. App. filed Nov. 2, 1920. Loop type for making precision measurements.

1,413,027. AUTOMATIC TELEPHONE SYSTEM; Harry H. Ide, La Grange, Ill. App. filed July 29, 1918. Individual line switches connect calling line to idle trunk.

1,413,049. VISUAL TELEGRAPH SIGNAL; Arthur H. Matthews, Limoilou, Quebec, Can. App. filed May 4, 1918. Same code as telegraph with magnets operating light shutter.

1,413,053. ELECTRICALLY HEATED BRANDING DIE; Albert H. Onstad, Tacoma, Wash. App. filed Jan. 10, 1921. Heated by induction currents.

1,413,057. ELECTRIC IRON; Theodore C. Plath, Los Angeles, Cal. App. filed Nov. 8, 1920. Iron heated only while on stand.

1,413,091. ELECTRIC SYSTEM OF POWER TRANSMISSION AND REGENERATIVE BRAKING; Clinton J. Axtell, Schenectady, N. Y. App. filed Feb. 4, 1918. Automatically adjusts braking load with speed change.

1,413,093. ELECTRIC ARRESTOR; Peter Bendmann, Frankfort-on-the-Main, Germany. App. filed April 1, 1921. Magnetically controlled switch for short-circuiting spark gap.

1,413,158. MOTOR GENERATOR DRIVE; William Caple, Homestead, Pa. App. filed July 11, 1921. Two motors for driving any or all of four generators.

1,413,202. TIMING DEVICE; John M. Torrence, Decatur, Ga. App. filed May 25, 1920. Alarm for kitchen use.

1,413,226. STORAGE-BATTERY CELL; Carl F. High, Madison Wis. App. filed Nov. 22, 1920. Leakage prevented by arrangement of two covers.

1,413,239. OVERLOAD PROTECTIVE DEVICE; Edwin W. Seeger, Milwaukee, Wis. App. filed July 24, 1920. Motor relay cut out for starting.

1,413,250. SWITCH SYSTEM FOR MINE LOCOMOTIVE; William E. Wolfe, Wilder, Va. App. filed April 28, 1920. Trolley and reel gathering system.

1,413,276. ELECTRIC REGULATION; Walter W. Hunzicker, Lafayette, Ind. App. filed Oct. 6, 1919. Lighting systems for electric cars.

1,413,304. ELECTRIC WELDING APPARATUS; Philip J. Walsh, San Francisco, Cal. App. filed Dec. 6, 1920. Remote switch operated by pressure on handle.

1,413,318. ENGINE STARTER; Alvin E. Buchenberg, Toledo, Ohio. App. filed April 14, 1919. Electromagnet carries movable pinion to engage flywheel.

1,413,322. ELECTRIC IMMERSION HEATER; David H. Clark, Orangeburg, N. Y. App. filed July 2, 1921.

1,413,329. SELECTOR; Paul Gnifke, Milwaukee, Wis. App. filed July 16, 1917. Step-by-step selector for telephone.

1,413,357. ELECTRICAL TRANSMISSION SYSTEM; Paul A. Raibourn, New York, N. Y. App. filed Dec. 29, 1920. Carrier-current signaling system for central stations.

1,413,368. MACHINE-SWITCHING TELEPHONE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Nov. 1919. Circuits for impulse and supervisory relays.

1,413,374. ELECTROMAGNET; Charles E. Avery, Trenton, N. J. App. filed July 10, 1917. Armature vibrates in a submultiple of energizing current.

1,413,390. PRESSURE VARIABLE RESISTANCE; Alexander Churchward, New York, N. Y. App. filed June 24, 1919. Ventilating system for carbon-pile pressure resistances.

1,413,501. SWITCH-CONTROLLING SYSTEM; Franklin A. Stearn, Paterson, N. J. App. filed Dec. 16, 1919. Machine-switching telephone apparatus.

1,413,544. CONTROLLER FOR ALTERNATING-CURRENT MOTORS; Arthur Simon, Milwaukee, Wis. App. filed Dec. 26, 1919. Eliminates phase distortion on open-delta transformer loads.

(Issued April 25, 1922)

15,341 (reissue). AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Edward B. Craft, Hackensack, N. J. App. filed April 7, 1919. Automatic switch for trunk finder.

1,413,639. SWITCHING DEVICE; Lee R. Waller, Westmount, Quebec, Canada. App. filed Nov. 13, 1920. Step-by-step, for telephone systems.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Boston Elevated Railway Company will soon begin work on the superstructure for the addition to its power plant on First Street, cost about $900,000.

LOWELL, MASS.—Extensions to the ornamental street-lighting system on East Merrimack and Gorham Streets are under consideration.

NEW HAVEN, CONN.—A permit has been granted to the United Illuminating Company for the erection of a transformer station at 117 Tryon Street, to cost about $7,000.

Middle Atlantic States

ARKPORT, N. Y.—The Public Service Commission has granted the village of Arkport permission to construct and operate an electric light and power system. Electricity for operating the proposed system will be obtained from the Hornel (N. Y.) Electric Company.

BROOKLYN, N. Y.—The Brooklyn Edison Company has awarded a general contract to Thomas Drysdale, 250 Baltic Street, for the erection of its new power plant at the foot of Sixty-sixth Street, to cost about $1,200,000.

DUNKIRK, N. Y.—A special election will be held May 24 to vote on the proposal to issue $1,400,000 in bonds for a municipal hydro-electric plant.

EAST AURORA, N. Y.—The East Aurora Electric Light Company will change its entire system this year to 25 cycles, three phase, for lighting and power service. A 12-mile, 22,000-volt transmission line is being erected to furnish electricity to maintain this system. A. R. Tremaine, Lancaster, is manager.

MEDINA, N. Y.—S. A. Cook & Company will construct a new power house at their furniture factory.

NEW YORK, N. Y.—A new power plant will be installed in connection with a seven-story building to be erected at the Teachers' College at 120th Street and Broadway, to cost about $1,500,000.

NEW YORK, N. Y.—The New York Edison Company will build a substation at 38 Bowery, to cost about $30,000.

NEW YORK, N. Y.—The International Paper Company, 30 Broad Street, has preliminary plans under way for the construction of a series of hydro-electric plants in the vicinity of Sherman Island and other points in northern New York and has acquired power sites capable of developing 40,000 hp. The plans include transmission and distributing lines for general commercial service. The initial plant of 20,000 hp. capacity will be located on Sherman Island.

CAMDEN, N. J.—Electric motors, switchboard and other electrical apparatus will be installed in the new four-story printing plant to be erected at Eighteenth and Federal Streets by the Haddon Press Corporation, affiliated with Harper & Brothers, Franklin Square, New York, to cost $250,000, including equipment.

CHATHAM, N. J.—The Commonwealth Electric Company, Summit, will extend its lines in Chatham Township to furnish service in territory which has heretofore been supplied by the Chatham municipal power plant.

JERSEY CITY, N. J.—The Public Service Electric Company, Newark, contemplates building an addition to its power station at Jersey City, to cost about $150,000. N. A. Carle is engineer.

NEWARK, N. J.—The Public Service Electric Company will construct new transmission lines from its Essex and Marion power plants to a point in Jersey City for service in connection with the construction of the new vehicular tunnel under the Hudson River, where a substation will be erected. The company has contracted to furnish the entire power supply in connection with the work.

RUTHERFORD, N. J.—The Council will install a new lighting system on Paterson Avenue. It is also proposed to install a new system in the East Rutherford business district.

CANADENSIS, PA.—The New Spruce Cabin Inn is having plans prepared for an electric power plant in connection with a new hotel. George W. Backoff, 49 Park Place, Newark, N. J., is engineer.

CHAMBERSBURG, PA.—Bids will be received by the Borough Council until May 15 for the construction of a municipal power plant, to cost about $150,000. Albert C. Wood, Stock Exchange Building, Philadelphia, is engineer.

FARRELL, PA.—The Shenango Valley Electric Light Company, Sharon, is planning to install an ornamental street-lighting system in Farrell, consisting of 103 standards, mounted with lamps of 400 cp., to be owned by the borough, for which the company will supply electricity. The company is also installing a new incandescent street-lighting system here, consisting of 263 lamps, of which fifty-eight will be of 250 cp. and the remainder of 100 cp. M. Pendleton, Sharon, is superintendent.

HEMPFIELD, PA.—Earl R. Myers has been granted a franchise to install a power plant and system for service in a portion of East Hempfield township.

JOHNSTOWN, PA.—The Penn Public Service Corporation has issued $4,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEW WINDSOR, MD.—The Council has taken over the property of the New Windsor Electric & Water Company to be operated by the municipality. Extensions and improvements will be made.

FAIRMONT, W. VA.—The West Penn Traction & Water Power Company, Pittsburgh, is negotiating for the purchase of the property of the Monongahela Power & Railway Company. If acquired, a transmission line will be erected to connect the two systems, and extensions and improvements made in the plant and lines of the Monongahela company.

IAEGER, W. VA.—The Pocahontas Red Ash Coal Corporation, recently organized, is planning to erect a power plant at its local properties and the installation of electric mining machinery. James G. Magowan is president.

RICHMOND, VA.—A new lighting system will be installed on Main Street from Eighteenth Street to Monroe Park, for which the sum of $28,000 has been appropriated.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer of the United States Army until May 25 for sixteen storage batteries (Circular PR 11094-1 CP); also, until May 27 for 30,000 SC type DA-10 batteries (Circular 10010-A-205 CP), and, until May 19 for 38,000 ft. cable and reels (Circular 10704-1 CP).

North Central States

ADA, OHIO.—A new steam-heating and power-plant and water system will be installed at the Ohio Northern University. The building will also house the machine shop, electrical and mechanical laboratories. Further information may be obtained by addressing C. R. Alden, Ohio Northern University.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until May 19 for paper-insulated, lead-covered cable. Bids will also be received at the same time and place for ornamental lamp standards.

COLUMBUS, OHIO. — Bids will be received by the Department of Public Welfare, Administration Building, until May 25 for the following: Engine and generating unit, boilers and stokers, for the Cleveland State Hospital; engine and generating unit, boiler and stoker, for the Institution for Feeble-Minded, Orient; generating unit, Ohio Penitentiary, Columbus; boilers and stokers, Ohio State Reformatory, Mansfield; boilers and stokers, Ohio Soldiers' & Sailors' Home, Sandusky; engine and equipment, Hospital for Epileptics, Gallipolis, and boilers, stokers, etc., for the Toledo State Hospital.

SALEM, OHIO. — The Salem Lighting Company contemplates improvements to its distribution system and the erection of a rural 2,300-volt distribution line along the high-tension line. R. Z. Zimmerman is general superintendent.

SPRINGFIELD, KY.—The power house of the Springfield & Campbellsville Utilities Company was recently destroyed by fire, causing a loss of about $100,000.

ATTICA, IND.—Improvements are being made to the municipal electric light and water plant, including the installation of a 1,000-kw. General Electric turbo-generator with condenser and switchboard equipment. B. H. Freeland is general superintendent.

HAMMOND, IND.—The Northern Indiana Gas & Electric Company has issued $7,000,000 in bonds, part of the proceeds to be used for extensions and improvements. C. H. Geist is president.

CHICAGO, ILL.—The Sanitary District of Chicago, 910 South Michigan Avenue, is preparing plans for a new hydro-electric plant, to cost about $3,000,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

MARENGO, ILL.—The Elgin & Belvidere Electric Railway Company will build a power plant, 50 ft. x 105 ft., to cost about $50,000.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company has acquired the property of the Ironwood & Bessemer Railway & Light Company, Ironwood, Mich. Extensions and improvements are contemplated, including a new hydro-electric generating plant, to cost about $1,600,000.

AUSTIN, MINN.—George A. Hermel & Company are planning to erect a two-story power house and a refrigerating and cold-storage plant. Henry I. Church is engineer.

JEFFERSON, IOWA. — The Jefferson Electric Company is installing two 300-hp. water-tube boilers, to replace present boilers, and one 500-hp. engine. Percy Gray is secretary.

LAKE CITY, IOWA.—A new company, it is reported, will be organized to construct and operate an electric plant in Lake City. H. B. Yetter is interested in the project.

MAQUOKETA, IOWA. — Bonds to the amount of $70,000 have been voted for extensions to the municipal electric light plant. The new unit will furnish electricity for lighting the residential part of the city. The present plant furnishes service in the business section.

MAQUOKETA, IOWA.—The Iowa Electric Company, Cedar Rapids, is completing plans for the construction of a hydro-electric plant on the South Fork of the Maquoketa River, to cost about $175,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

LIBERTY, MO.—Bids will be received by the City Clerk until May 17 for two motor-driven centrifugal pumps, with switchboard, starters, etc., complete, for the waterworks system. W. E. Barnes is engineer.

LENNOX, S. D.—The local electric light plant, owned by H. B. McFarland, was recently destroyed by fire. The Northern States Power Company, Sioux Falls, it is reported, is making arrangements to furnish permanent service in Lennox.

BEAVER CITY, NEB. — The municipal electric light plant was recently destroyed by fire.

CLAY CENTER, KAN.—The Republican River Power Company contemplates the construction of a hydro-electric power plant at its present dam on the Republican River, to cost about $150,000.

Southern States

BELHAVEN, N. C.—The Council is considering plans for doubling the output of the municipal electric light plant. William C. Olson, Kinston, is consulting engineer.

DONATION, N. C.—The National Soapstone Company, First National Bank Building, Roanoke, Va., plans to erect a power house at its local works. George W Hutchinson, Express Building, Roanoke, is engineer.

LENOIR, N. C.—A hydro-electric development on Wilson's Creek, near Lenoir, to cost about $100,000, is contemplated by Kistler & Milner, Morgantown.

QUINCY, FLA.—At an election to be held May 16 the proposal to issue $98,000 in bonds for improvements to the municipal electric light, water and sewer systems will be submitted to the voters.

KNOXVILLE, TENN. — The Knoxville Railway & Light Company contemplates extensions to its electric plant and system, to cost about $150,000.

EVERGREEN, ALA.—Bids will be received by the City Council until June 1 for electrical equipment for the proposed municipal power plant. W. W. Hill, Auburn, is consulting engineer.

MOBILE, ALA. — The Mobile Electric Company is planning to install a new street-lighting system.

BATESVILLE, MISS. — Bonds to the amount of $25,000 have been voted for the installation of a municipal electric plant.

BOONEVILLE, MISS.—The Light, Water & Ice Company may possibly install a series street-lighting system. Further information may be obtained from C. W. Bolton.

LAFAYETTE, LA.—Extensions are contemplated to the municipal light plant to increase the output to 500 kw., to cost about $100,000. A Diesel engine and generator will be installed.

FAIRLAND, OKLA. — Bonds to the amount of $21,500 have been voted for the installation of an electric distributing system. H. G. Olmstead & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

OKEENE, OKLA.—Bonds to the amount of $45,000 have been voted for extensions and improvements to the municipal power plant. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CELINA, TEX.—The Council has authorized estimates of cost made for a municipal electric plant. Montgomery & Ward, Wichita Falls, are engineers.

LIVINGSTON, TEX. — The Council is having revised plans prepared for the installation of a municipal electric light and power system and will call for new bids at an early date. E. E. Sands, Houston, is consulting engineer.

SAN ANTONIO, TEX.—The San Antonio Public Service Company has awarded contract for a 15,625-kva. turbo-generator for its station "B" power plant and two 500-hp. boilers. E. H. Kifer is vice-president and general manager.

Pacific and Mountain States

LANGLEY, WASH.—The Langley Light & Power Company is planning to install a boiler (already purchased), a 40-hp. steam engine and a 30-kva. alternator and to make some line extensions. Philip Simon is president and manager.

OLYMPIA, WASH.—A petition has been presented to the City Council by business men asking for the installation of a new ornamental lighting system in the business section of the city, to cost about $14,000.

TACOMA, WASH.—The City Council has passed an ordinance authorizing the Mayor to enter into a contract with the Consumers' Central Heating Company for the purchase of steam to generate electricity required for the city over and above the capacity of the municipal plant at Nisqually.

ALBANY, ORE.—The Mountain States Power Company contemplates the erection of a 60,000-volt transmission line to connect its local plant with the power station at Dallas to provide an alternate supply for the city.

PORTLAND, ORE.—The Federal Power Commission has granted the Portland Railway, Light & Power Company permission to appropriate water from the Oak Grove and Three Links branches of the Clackamas River to develop about 40,000 hp. The plans provide for an ultimate development of 100,000 hp., to cost about $10,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has been granted permission by the State Water Commission to construct a hydro-electric plant on Deer Creek, Fresno County, with initial capacity of 8,800 hp., to cost about $1,200,000.

FULLERTON, CAL. — Bids will be received by the City Trustees until May 23 for the installation of an ornamental street-lighting system, comprising 156 standards. Benjamin F. Dupuy is city engineer.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until May 19 for a synchronous-condenser installation. (Specification No. P-261.) James P. Vroman is secretary.

OAKLAND, CAL.—Plans are being prepared for an ornamental street-lighting system on San Pablo and Telegraph Avenues and Broadway, combined trolley and lamp poles to be used, each mounted with two 1,500-cp. lamps. D'Arcy Ryan is engineer.

SAN FRANCISCO, CAL. — The Great Western Power Company has issued $2,000,000 in bonds, part of the proceeds to be used for a hydro-electric plant and for extensions and improvements.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has made application to the State Water Commission for permission to use sites and water power as follows for proposed hydro-electric plants: Clear Creek, Butte County, to develop 4,781 hp., to cost about $254,000; Fordyce Creek, Butte County, 17,035 hp., $745,000; Deer Creek, Alpine County, 15,945 hp., $357,000, and North Fork of Feather River, Butte County, 3,586 hp., $182,000.

STOCKTON, CAL.—The Western States Gas & Electric Company has been granted permission by the State Water Commission to construct a hydro-electric plant on the South Fork of the American River, Eldorado County, to develop 61,200 hp., to cost about $2,500,000.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has issued bonds for $5,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company contemplates extensions and improvements, to cost including equipment, about $150,000.

HARDIN, MONT.—The Federal Power Commission has granted the Big Horn Canyon Irrigation & Power Company, Hardin, a preliminary permit for a power plant at the mouth of Big Horn Canyon, 42 miles from Hardin.

BASIN, WYO.—A special election has been called to vote $60,000 in bonds for improvements to the municipal electric plant and waterworks station.

SHOSHONI, WYO.—The Wyoming Power Company has been granted permission by the Federal Power Commission to construct a hydro-electric plant at Boyseh Dam on the Big Horn River, Wyo.

CASTLE ROCK, COL. — Plans for the construction of a municipal electric light plant are under consideration by the City Council.

Canada

CLOVERDALE, B. C.—Plans are being prepared by J. O'Hara, municipal engineer, for a street-lighting system for Cloverdale.

NELSON, B. C. — The East Kootenay Power Company, Ltd., has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements, including a hydro-electric development on the Elk River, Kootenay Mining district.

VANCOUVER, B. C.—The Granby Consolidated Mining, Smelting & Power Company is planning to build a hydro-electric plant at its properties at Anyox, to cost about $400,000, including machinery.

ST. JOHN, N. B.—Contract has been awarded by the New Brunswick Hydro-Electric Commission for the erection of an electric transmission line, to supply energy to the city of St. John, to the Canadian Bridge Company, Ltd., Walkerville, Ont. Surveys for the proposed line have been completed to Moncton.